



ICONTEC
INTERNATIONAL

**PERIODIC VERIFICATION
REPORT**

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**VERIFICATION OF THE
LA VUELTA AND LA HERRADURA HYDROELECTRIC PROJECT
(UNFCCC REGISTRATION REF. N°: 0735)**

**Empresas Públicas de Medellín E.S.P
(COLOMBIA)**

VERIFICATION PERIOD:
2005 01 01 TO 2007 12 31

REPORT N°. CDM VER-004-06

JANUARY 2009

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<p>Approved by:</p> <p>Climate Change Committee of ICONTEC</p>	<p>Organizational unit:</p> <p>Instituto Colombiano de Normas Técnicas y Certificación – ICONTEC Cra. 37 52-95 Phone: +57-1-6078888 Ext.: 1251/1353 Bogotá</p>
<p>Client:</p> <p>Empresa Públicas de Medellín E.S.P.</p>	<p>Client ref.:</p> <p>CR 0735</p>

Summary:

The Instituto Colombiano de Normas Técnicas y Certificación - ICONTEC, carried out the first verification of the GHG emissions reduction due to La Vuelta and La Herradura Hydroelectric Project in Medellín, Colombia by reviewing the findings of the project from 2005 01 01 to 2007 12 31.

La Vuelta and La Herradura Hydroelectric Project is a regular run-of-river type hydroelectric project, introduced into the National electric system of Colombia, located on the north of the Antioquia Department. It was scheduled to begin operations in the first semester of 2004.

We carried out a Verification plan that included desk review and on-site assessment, as follows:

- September 18, 2008: Preparatory Verification Team meeting and Desk review.
- September 25, 2008: Opening Meeting at EPPM's Headquarters in Medellín.
- September 26 and 27, 2008: On-site Visit of the La Vuelta and La Herradura facilities and Chorodó substation. Interview with the project participant's personnel and the stakeholder's delegates.
- September 29, 2008: Interview with XM (Experts Market) and CND (National Center of Dispatch) personnel.
- October 2, 2008: Preliminary Verification report
- October 7, 2008: Close meeting
- January 5th, 2009: Final Verification report

For the verification we used as reference the Article 12 of the Kyoto Protocol and CDM modalities and procedures according to the Marrakech Agreement, the criteria of the CDM Executive Board and the host country, as well as the operational and technical monitoring criteria specific for this type of project.

The verification team applied the recommendations of Validation and Verification Manual, addressed to the identification of risks associated to the verification process. In this case we did not identify potential risks.

Documentation review, interviews and on-site visits allowed us to collect enough evidence to completely assess the verification criteria and determine that the emissions reduction were correctly calculated based on PDD, monitoring plan and appropriate application of methodology *ACM0002 (version 6): "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"*.

Based on the above issues, ICONTEC is able to certify that the GHG emissions reduction of La Vuelta and La Herradura Hydroelectric Project, during the crediting period assessed from 2005 01 01 to 2007 12 31, amounted 154 232 tons /CO₂ equivalent.

Report No.: CDMVER 004-06	Subject Group: Verification	
Report title: Verification Report of La Vuelta and La Herradura Hydroelectric Project – Colombia		
Work carried out by: Eng. Juan Alberto Gracia (LA) Eng. Fernando Gómez (EE) Eng. Liliana Soto (AT)		
Work verified by: Climate Change Committee – ICONTEC		
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Indexing terms

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Abbreviations

ICONTEC Instituto Colombiano de Normas Técnicas y Certificación

DNA	Designated National Authority
CER	Certified Emission Reduction (s)
EEPPM	Empresas Públicas de Medellín E.S.P. (Generador, Comercializador y Distribuidor de Energía Eléctrica (Grid Operator))
FAR	Forward Action Request
CDM	Clean Development Mechanism
CO2	Carbon Dioxide
DOE	Designated Operational Entity
GHG	Greenhouse Gases
MP	Monitoring Plan
PDD	Project Design Document
UNFCCC	United Nations Framework Convention for Climate Change
LA	Lead Auditor
AT	Auditor in training
EE	Energy Sector Expert
XM	“XM” (Experts Market) is a company of the ISA Group providing integral services. (www.xm.com.co).
NEON	It is an information service about the Colombian Wholesale Power Market that allows the market agents to obtain, in an interactive way, information of the operational process and the results of the liquidation of the transactions done in the Power Block Market.
CREG	Comisión de Regulación de Energía y Gas (Regulatory entity of energy sector in Colombia)
UPME	Unidad de Planeación Minero-energética (Ministry of Mines and Energy - Energy planning Unit).
UMATA	Regional Environmental Authority

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Annex 1: Periodic Verification Checklist

1. Introduction

The Empresas Públicas de Medellín E.S.P. (EEPPM) has commissioned an independent verification by ICONTEC of its reported greenhouse gas (GHG) emission reductions from the La Vuelta and La Herradura Hydroelectric Project. The DOE have reviewed the GHG data collected to date for the period from 2005 01 01 to 2007 12 31. This report contains the findings from the verification and certification statements for the certified emission reductions.

1.1 Objective

According to CDM Modalities and Procedures (Decision 17/CP.7) the purpose of the verification is the periodic independent review and ex-post determination by the DOE of the monitored reductions in anthropogenic GHG emissions by sources, which have occurred as a result of a registered CDM project activity during the verification period.

Certification is the written assurance by the DOE that, during a specified time period, a project activity achieved the reductions in anthropogenic GHG emissions as verified.

Taking into account that the monitoring plan and the methodology included in the PDD for this project is based on the measurement of the power generated, the verification was mainly focused on establishing both the validity of the procedure followed to obtain and record this measurement and its reliability and quality.

1.2 Scope

The verification aims:

- To determine whether the project documentation provided is in compliance with the requirements of the registered project design document, relevant provisions of decision 17/CP.7 and relevant decisions of the COP/MOP;
- To conduct on-site assessment, including a review of performance records, interviews with project participants and local stakeholders, measurements, compliance of established practices and testing of the accuracy of monitoring equipment.
- To review monitoring results and verify that the monitoring plan has been correctly applied and their documentation is complete and transparent.
- To recommend to the project participants the appropriate changes to the monitoring plan, if necessary.
- To determine the reductions in anthropogenic GHG emissions by sources that would not have occurred in absence of the CDM project activity, using calculation procedures according to the registered Project Design Document and the Monitoring Plan.

- To identify and inform the project participants of any concerns related to the actual project activity and its operation compliance with the registered project design document. Project participants shall address the concerns and supply relevant additional information.

To provide a verification report to the project participants, the parties involved and the Executive Board. The report shall be made publicly available.

The verification does not provide consultancy service to the client. ICONTEC, based on its ethics code and internal procedures for validations, verifications and certification of CDM project activities (which, in turn, are based on the Validation and Verification Manual) focused on the identification of significant risks for CER generation, and verification of the mitigation.

1.3 Description of the Project Activity

Project Parties:	Empresas Públicas de Medellín E.S.P. Electric Power Development Co., Ltd.
Title of project activity:	La Vuelta and La Herradura Hydroelectric Project
UNFCCC registration No:	0735
Project Entity:	Empresas Públicas de Medellín E.S.P. Official Contact: Federico José Restrepo Posada Gerente General Empresas Públicas de Medellín E.S.P. Address: Carrera 58 N° 42-125 Medellín, Antioquia Department - Colombia Federico.restrepo@epm.com.co phone: + 57-4 – 3808080 fax: + 57-4- 3806795
Location of the project activity:	La Vuelta: -76°05'18.01" 6°43'49.60" La Herradura: -76°04'52.90" 6°48'10.08" Substation Chorodó: -76°08'16.50" 6°50'53.93"
Project's crediting period	Antioquia Department Colombia 7 years
Verification period	2005 01 01 to 2007 12 31
Projects starting date	La Vuelta started operation: 2004 12 18 La Herradura started operation: 2004 10 08

1.3.1 Project Location

The Republic of Colombia is located in Northern South America bordering the Caribbean Sea, between Panamá and Venezuela and bordering the North Pacific Ocean, between Ecuador and Panamá. The project is located in the north-western area of Antioquia Department, using water from La Herradura River, 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. In this zone of approximately 230 km², important municipalities, such as Dabeiba, Mutatá, Chigorodó, Apartadó, and Turbo are located.

La Herradura subproject takes place 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 catchments' point. The construction is located in Frontino and Cañasgordas jurisdictions.

La Vuelta subproject takes place in the upper and middle La Herradura River basin, up to the fork at the Nancuít gulch, at 1,595 m elevation, covering all Abriaquí municipality and the limits coincide with the dividing basin and to a lesser extent with Frontino municipality. The hydrographic basin area of La Herradura River is 286 km², which contributes to a mean flow of 12.3 m³/s at catchments' point.

A key objective of the project is to reduce Greenhouse Gas Emissions that would have otherwise been generated by the National Interconnected System of Colombia.

1.3.2 Project connection to the national grid

La Vuelta and La Herradura power plants are connected to Chorodó substation at 44 kV level through single circuit lines, 13.9 km and 6.6 km. length respectively. At Chorodó substation there is a step up 44kV/110kV 30-40 MVA transformer, which is connected to the national grid at Occidente 110/220 kV substation through the 110 kV line Chorodó - Antioquia - Occidente.

2. VERIFICATION METHODOLOGY

2.1 General

2.1.1 Verification team

The verification team is composed of the following staff:

Mr. Juan Alberto Gracia Team Leader, CDM Lead Auditor
Mr. Fernando Gómez, Energy sector expert
Ms. Liliana Soto, CDM Auditor in training
Ms Josefina Baldrich, Internal verifier (CDM Certification Committee)
Ms Rosa Cano, ICONTEC Expert (CDM Certification Committee)

2.1.2 Verification Schedule

Preparation: From 2008 09 08 To 2008 09 19

On-site verification: From 2008 09 25 to 2008 09 29

Preliminary Reporting: From 2008 10 02

Final Verification Report: From 2009 01 05

2.2 Review of Documentation

In order to be able to carry out the documentation preliminary review, the following documents were requested to the project participants:

- Validation report 2006 10 23 rev 2, DNV report.
- Last version of PDD ver 6 and attached documents.
- Reports and records of hourly, daily, monthly and annual monitoring data on the items defined in the monitoring methodology and plan and Monitoring Report of the crediting period from 2005 01 01 to 2007 12 31.
- Quality Assurance Manual, procedures for internal audit and plant operation and maintenance, as well as for measuring equipment calibration, and information security.
- Information on the applicable environmental regulations (see 5. References).
- Specifications for the Hydroelectric Plants equipment.
- Communications with the project stakeholders.

Every document was reviewed and a verification plan was structured and sent to the project participants.

The monitoring report of the crediting period was made publicly available in UNFCCC web site the 2008 09 05.

2.3 Site Visits

Since September 25th to 29th, 2008 the project was visited at the following facilities:

- La Herradura Hydroelectric Plant
- La Vuelta Hydroelectric Plant
- Chorodó electrical substation
- EEPPM Metrology Labs (electrical meters)
- EEPPM Control Center
- National Dispatch Center (XM offices)

Interviews were conducted to the plant's personnel, EPPM Directors and Technical Supervisor, XM Director and personnel, UPME Experts and project stakeholders as Frontino authority and Cañasgordas environmental authority were also interviewed.

During on-site visit the following people were interviewed:

Entity	Name	Position
EEPPM	Gloria Amparo Bustamante	Social Professional
EEPPM	Isabel Cardona	Energy transaction Specialist
EEPPM	Camilo Garizabal	Planning Professional -CDM Specialist
EEPPM	Iván Dario Estrada	Measurement Team specialist
EEPPM	Oscar Hernán Montoya	Measurement Team specialist
EEPPM	John Jairo Tamayo	Engineer (Measurement Team Specialist)
EEPPM	Jaime Aramburú	Planning Professional -CDM Specialist
EEPPM	John Jairo Giraldo	Inspector
EEPPM	Diomer Ignacio Díaz	Central Operator
EEPPM	Eduardo Mazo	Central Operator
EEPPM	Manuel Hoyos	Leader Engineer of La Vuelta and La Herradura
EEPPM	Oscar Fernández	Register Specialist
EEPPM	Carlos Vélez	Planning Specialist
EEPPM	Cesar Echavarría	Substation operator
Frontino Authority	Luzdary Tamayo	Environmental and Rural Development Director
XM	Álvaro Murcia	CND Manager
XM	María Nohemi Arboleda	Market Transaction Director
XM	Jaime Alejandro Zapata	Commercialization Transaction Specialist
XM	Luis Julian Zuluaga	Dispatch Specialist
Cañasgordas Environmental Authority	William Correa Uribe	UMATA Director
UPME	José Vicente Dulce	Engineer Advisor
UPME	Ciro Serrano	Engineer Advisor

2.4 Assessment

ICONTEC performed the verification by:

- reviewing project documentation;
- on-site inspections, including review of facilities installations (water conduction system, power generation and transformation), performance records, and interviews with project participants;

- collecting measurements, observing established practices and verifications of the accuracy of monitoring equipment;
- cross-checking measurements of plant generation;
- reviewing monitoring results and checking the correct application of monitoring methodologies and data, and
- setting the GHG emissions reductions.

The verification assessment included the following aspects:

- a) Implementation and follow up to the monitoring plan, including verification of:
 - all data on project emissions reduction and follow up indicators of sustainable development;
 - responsibilities and related authorities;
 - monitoring frequency;
 - accuracy of the equipment used for monitoring, control and calibration;
 - consistency of results, their approval and revision;
 - controls to prevent, detect, and correct any errors or omissions in the monitoring guidelines.
- b) Precision of the project information (materiality) including assessment of the absence of:
 - inconsistencies in the use of formulas in spreadsheets and their connections;
 - inappropriate use of the methodology approved;
 - errors in data due to failures during the digitizing process;
 - inappropriate use of data.
- c) Verification of consistency of data resulting from the project operation regarding the baseline.
- d) Analysis of potential risks to the project.
- e) Quality assurance and management system

The verification process was guided by this checklist, which ensures a transparent verification process, and demonstrates how emission reductions have been verified and how the verification findings have been reached.

2.5 Reporting of Findings

There are 6 Clarification request for the project activity (See Annex 1 Table 4).

3. VERIFICATION FINDINGS

3.1 Remaining issues, CARs, FARs, from previous validation or verification

There are no remaining open issues, CRs, CARs, from validation.

3.2 Project Implementation

Firstly, the physical conditions related to the Project characteristics were verified in order to establish the correspondence between the technical issues described in the PDD and the actual installations. In the Table 1 is showed a comparison between PDD data and plate data of power plant equipment installed as founded in La Vuelta and La Herradura power plants:

Table 1: Comparisons between PDD Equipment data and actual equipment of the Plants

PDD DATA						
	La Vuelta			La Herradura (1)		
	Plant	turbine	Generator	Plant	Turbine	Generator
Caudal	12,00	11,97	-	10,00	5,00	-
Net Heat	112,90	112,90	-	230,60	230,60	-
Power MW	11,70	12,25	11,90	19,80	10,40	10,20

PLATE DATA						
	La Vuelta				La Herradura (1)	
		Turbine	Generator		Turbine	Generator
	-			-		
Caudal	-	12,00	-	-	5,00	-
Net Heat	-	112,90	-	-	230,6	-
Power MW	-	12,40	11,9	-	10,54	10.20

(1) Data per Unit

It can be seen that installed power house equipment strongly comply the mechanical and electric characteristics foreseen in the PDD.

Outdoor in La Vuelta site was found a substation with a 13.8/44 kV, 14 MVA transformer and associate measurement and control equipment, that fairly well match with the power plant

characteristics. Also the output module for the 44 kV transmission line from La Vuelta to Chorodó substation was confirmed.

In the same way, outdoor in La Herradura site was found a substation with a 13.8/44 kV, 24 MVA transformer and associate measurement and control equipment, that fairly well match with the power plant characteristics. Also the output module for the 44 kV transmission line from La Herradura to Chorodó substation was confirmed.

Besides that, the infrastructural installations related to water management and conduction in La Vuelta and La Herradura sites were found as described in the PDD.

According to the PDD, the electric energy generated in La Vuelta and La Herradura power plants is injected to the national grid in substation Chorodó, immersed in the transmission system of EEPPM. On-site inspection to this substation demonstrated that La Vuelta and La Herradura power plants are connected to Chorodó substation at 44 kV level through single line circuits, 13.9 km and 6.6 km. length respectively, according to the respective single line diagram. At Chorodó substation there is a step up 44kV/110kV 30-40 MVA transformer, which is connected to the 220 kV level at substation Occidente 110/220 kV through the 110 kV line Chorodó-Antioquia-Occidente.

As established in the PDD, La Vuelta and La Herradura is a CDM project activity related to renewable electricity connected to a grid. The monitoring shall consist of metering the electricity generated by the renewable technology. Based on the above considerations, the Verification Team considers that the power received at the arrival point of the transport lines connecting La Vuelta and La Herradura hydroelectric plants to Chorodó Electrical Substation in the transmission system of EEPPM adequately represents the renewable power that effectively originates the emissions reduction.

In our opinion the individuals responsible for the project have implemented all the activities according to the PDD and the monitoring plan.

Additionally, and under responsibility of EEPPM, social and environmental benefits have been implemented in the Frontino, Abriaquí and Cañasgordas region in joint with Municipality authorities like:

- a) 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 to establish of agro-forestry areas that benefit the communities.
- b) A further agreement regarding food safety and environmental protection was also signed with Frontino municipality.
- c) 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.

3.3 Completeness of Monitoring

3.3.1 Compliance between the Monitoring Plan with Monitoring methodology

Accordance to the PDD, the CDM Project Activity La Vuelta y La Herradura will be monitored following the guidelines of the approved consolidated monitoring methodology ACM0002 / Version 06, "Consolidated monitoring methodology grid-connected electricity generation from renewable sources". This Methodology requires monitoring of the electricity generation from the proposed project activity, as well as data needed to recalculate the Operating Margin (OM) emission factor and the Build Margin (BM) emission factor, related to the choice of the method to determine them, consistent with consolidated baseline methodology ACM0002. Project owner chose and justified Option C of the methodology to calculate the OM emission factor (Dispatch Data Analysis - DDA) as well as chose and justified Option 2 of the methodology to calculate the BM emission factor (Ex-post calculations to annually updating for the first crediting period).

The Monitoring Plan to be implemented is described in Sections D.2.1.3 "Relevant data necessary for determining the baseline of anthropogenic emission by sources of GHGs within the project boundary and how such data will be collected and archived", and D.4 "...Operational and management structure that the project operator will implement in order to monitor emission reductions..." of the PDD. In Section D.2.1.3 data variables with their associated characteristics of, sources, units, categories, recording frequency, proportion to be monitored, and means of archiving, are specified.

ICONTEC agree that variable data and characteristics exhibited in that section are just as needed to calculate the GHG emission reductions, keeping consistency with the consolidated monitoring methodology ACM0002 / Version 06, in the options chose. In Section D.4 there are explanations concerning: control and audit tasks on output information and data, calibration of electricity metering devices, operation procedures norms, monitoring procedures, and operation reports. The DOE consider that the explanations given are fairly adequate to monitor the data necessary to apply the monitoring methodology.

3.3.1.1 ICONTEC carried out the verification of the monitoring operations executed for the Project responsible on each parameter in Section D.2.1.3 of PDD, with the following results:

a) Electricity generated by La Vuelta and La Herradura plants (EG):

- Measurements availability:

Data on power energy generation of each power plant is measured in meters located at substation Chorodó, which is the commercial frontier where the electricity is injected to the national grid.

The commercial frontiers of La Vuelta and La Herradura Hydroelectric Plants are conformed by meters installed in the arrival panel of 44 kV lines from each power plant, two meters for each one, principal and back up, whose specifications are presented in the Table 2. The commercial frontiers

were officially registered in the Wholesale Power Market, with an effective capability of 31 MW, under the features indicated in Table 2:

Table 2. Specifications of Power Meter of La Vuelta and La Herradura Hydroelectric

METER SERIAL NUMBER	EXPORTER	IMPORTER	VOLTAGE LEVEL (kV)	HYDROELECTRIC PLANT	METER CLASS	START DATE
83342395	EEPPM	EEPPM	44	La Vuelta SIEMENS (Frontier)	0.2	2004 08 18
83342396	EEPPM	EEPPM	44	La Herradura SIEMENS (Frontier)	0.2	2004 08 18
77778378	EEPPM	EEPPM	44	La Vuelta LANDYS (Back up)	0.2	2004 08 18
77778354	EEPPM	EEPPM	44	La Herradura LANDYS (Back up)	0.2	2004 08 18

In the on-site visit to the substation Chorodó a check was made to verify that no feed back energy flows were eventually considered as generated by the power plants. This verification was based on a review of electrical connections outside in the switchgear and inside in the room control. It was clear that the equipment and the control system installed do not allows this type of operation, thus assuring that there is no feed back energy accounted as energy generated by the plant.

These issues allow us to affirm that the metering carried out at that substation of the power delivered by these circuits appropriately represents the power generated to be considered for GHG emission reduction calculations, as claimed by the Monitoring Plan.

Hourly registers of the meters are interrogated daily via phone applying the software *MV-90xi*, managed by the IT Department of EEPPM. The information is backed up through the corporate software *GCE* and settled, via internet, on the NEON platform, managed by XM, which is the official system used by every agents in the Block Energy Market in Colombia.

The record of the power bought and sold by the commercializing agents in the Wholesale Power Market in Colombia, and which is the basis for the execution of power sale contracts, is officially kept by the Company XM Experts Market (company of the ISA Group providing integral services of operation, administration and development of wholesale power markets), based on the information of the meters installed in the commercial frontiers.

The Verification Team established that this operational procedure complies with the operational and commercial scheme prevailing in Colombia, and that it strictly fulfils the regulatory requirements about this topic, especially those included in the Orders CREG 025 of 1995 (by which the commercial aspects are regulated regarding Wholesale Power Market in the national interconnected system which are part of the Operation Regulations) and CREG 006 of 2003 (by which the following aspects are adopted: standards on record of commercial frontiers and contracts, information supply and report, and liquidation of commercial transactions in the Wholesale Power Market).

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

EVLT1001 LA VUELTA
EHRD1001 LA HERRADURA

- Measurements accuracy:

In order to verify the reliability and accuracy of the metering, Tests Certificates were checked with their relevant Protocols corresponding to potential transformers (PT), current transformers (CT) and power meters, and the following results were found:

Test results: CONFORM

The Meters Laboratory of the EEPPM has Accreditation of the Superintendence of Commerce and Industry of Colombia.

Based on the abovementioned visits and certifications, the Verification Team provides positive opinion on the reliability and accuracy of the metering. And this calibration records evidence the continue confidence about the meters. The accuracy of equipment using of monitoring was verified.

- Measurements cross-check:

Electricity generation measurements trough the electronic meters installed in the commercial frontier in Substation Chorodó, and reported to XM, are cross-checked by EEPPM with generation registered directly in the SCADA system ("Supervisory Control And Data Acquisition") installed in La Vuelta y La Herradura power plants. This cross-checking was verified by the DOE.

In the technical visit of verification to the XM headquarters, the generation data of La Vuelta and La Herradura Hydroelectric Project submitted to XM by EPM were compared with those used by XM to execute the commercial accounting for the whole national market, with satisfactory results. Taking into account that these are just the data source from receipts of sales are produced by the Commercial Department of XM, this comparison is intended to be equivalent to the double checking by receipt of sales to the electricity supplied by the project activity to the grid, required by methodology ACM0002 version 6.

b) Plant dispatch order of the grid:

Plant dispatch order of the grid in the interconnected national electric system is stated by the National Dispatch Center (CND in Spanish)), which is operated by XM. The dispatch order is stated by NDC, in the so named "ideal dispatch", based on the price offers of the generators in the market. The offers are formulated each day up to 9:00 a.m, to be used for CND to program next day ideal dispatch. This information is free access for the agents. Real time operation is somewhat different of ideal dispatch because of transmission constrains and real operative conditions. Real time operation is free access too for the market agents. The DOE accomplished a visit to XM and CND and confirmed the issues just described.

Using ideal dispatch and real time operation data, EEPPM states the *Plant dispatch order of the grid*, using software based on dynamic excel tables. This dynamic table is, in fact, the tool used by EEPPM to calculate the Operating Margin (OM) emission factor, the Build Margin (BM) emission factor, and the emission reduction causes by the activity project.

c) Identification of the power plants for the OM (n)

Using ideal dispatch and real time operation data, and aided with the dynamic table above mentioned, EEPPM identify the set of power plants in the top 10% of grid system dispatch order during each hour of the period being calculated.

d) Identification of the power plants for the BM (m)

Information about date of commissioning of new additions to the national generation system is provided by the CND (Dispatch National Center), based on the registration of new generator commercial frontiers in the system. This public information is utilized by EEPPM to select power plants involved in the BM calculations. Using the above software, an ordering of plants is made, based on date of commissioning, starting with the most recent, in order to selection those that contribute with a 20% of total annual generation.

e) Electricity generated by each power plant (n or m) of the Colombian SIN (GEN)

The hourly records of actual electricity generated by each plant in the interconnected system, this data are taken daily by EEPPM from the platform NEON of XM.

f) Fuel data

In order to calculate OM and BM emission factors, EEPPM utilize directly emission factors of plants, listed in the PDD, Annex 3, Table 13: *CO₂ emission factors of thermal power plants*, in instead of emission factors of fuels, as claimed for original formulation in the methodology. However, in the concept of the DOE this is an equivalent approach.

3.3.2 Assessment of data and calculation of GHG emission reductions

According to the approved consolidated baseline methodology ACM0002/Version 06, the emission reductions ER by this type of project activity during a given year is the difference between baseline emissions (BE), project emissions (PE) and emissions due to leakage (L), where the baseline emissions are the product of the baseline emissions factor (EF), times the electricity supplied by the project activity to the grid (EG). For La Vuelta and La Herradura project, PE and L are zero, as demonstrated in the PDD, so the emission reduction is reduced to the product of the baseline emissions factor (EF), times the electricity supplied by the project activity to the grid (EG). The baseline emission factor (EF) is calculated as the average of the Operating Margin emission factor (EF_{OM}) and the Build Margin emission factor (EF_{BM}). As already explained, for La Vuelta and La Herradura project EF_{OM} is based on option C (Dispatch Data Analysis - DDA) and EF_{BM} is based on Option 2 (Ex-post calculations to annually updating for the first crediting period).

As already mentioned, EPPM utilizes software to apply the methodology ACM0002 Version 6 to assess the emission reduction caused by their CDM projects. Further, this software has been developed as a joint effort of Colombian institutions, jointly with the UPME.

The DOE carried out the verification of Monitoring Report (version November 5th, 2008) that presents of formulae and data used, as well as and calculation performed by the Project responsible, with the following results:

Operating Margin emission factor – EF_{OM}

The following formulae sequence was used:

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

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

$$EF_{DD,h} = \frac{\sum_{j,n} EF_j \cdot GEN_{j,n,h}}{\sum_{j,n} GEN_{j,n,h}} \quad (3)$$

$$EF_j = HR_{i,j} \cdot NCV_i \cdot EF_{CO_2,i} \cdot OXID_i \quad (4)$$

Where: the meaning of terms is the same as defined in the methodology.

Equation 3 uses Emission Factor of plants EF_j as presented in the PDD Annex 3, Table 13: CO₂ emission factors of thermal power plants. This table presents CO₂ emission factors (t CO₂/MWh) of thermal power plants in the Colombian interconnected system, which is calculated as showed in equation 4.

Specific values for NCV_i , $EF_{CO_2,i}$ and $OXID_i$ are taken from the PDD Annex 3, Table 11 Coal data and Table 12 Natural gas data, which are based in IPCC guidelines, as explained in the PDD.

Values for $HR_{i,j}$, the Heat Rate of part j, fuel i, listed in Table 13 above mentioned, correspond to data reported by the generation agents in the system to the official Operation and Regulatory Entities, CND and CREG.

The DOE considers that this approach is valid and agrees with the data used, taking into account the availability and confidence guaranty of the sources.

ICONTEC verified the correct application of the former formulae sequence in the program used by EPPM.

Also, the determination of the variables: Hourly electricity generated by La Vuelta and La Herradura plants (EG), Plant dispatch order of the grid, Identification of the power plants for the OM(n) (falling within the top 10% of the hourly system dispatch for the whole year), Hourly electricity generated by each power plant (n) of the Colombian grid (GEN), and Fuel plant data (HR, NCV, EFCO2, OXID) was verified.

The results, presented in the following spreadsheets were verified too:

"Margen_operacion_LVLH_2005.xls"
"Margen de operación 2006_2.xls"
"Margen de operación 2007.xls"

The annual Operating Margin emission factor – EF_{OM} obtained are:

Year 2005 OM: **0.3665** tCO₂/MWh
 Year 2006 OM: **0.3225** tCO₂/MWh
 Year 2007 OM: **0.2455** tCO₂/MWh

Build Margin emission factor - EF_{BM}

The following formula was used:

$$EF_{BM,y} = \frac{\sum_{j,n} EF_j \cdot GEN_{j,n}}{\sum_{j,n} GEN_{j,n}} \quad (5)$$

Where the meaning of terms is as defined in the methodology.

Equation 5, in the same way as equation 3, uses Emission Factor of plants EF_j from the PDD Annex 3, Table 13: *CO2 emission factors of thermal power plants.*

The same as per Operating Margin emission factor, the DOE considers that this approach is valid and agrees with the data used.

The DOE verified the correct application of the former formula in the program used by EEPDM.

Also, the determination of the variables: Identification of the power plants for the BM (n) (additions in the electricity system that comprise 20% of the system generation each year), and Electricity generated by each power plant (n) of the Colombian grid (GEN), was verified.

The results, presented in the following spreadsheets were verified too:

"MargenConstruccion_2005.xls"

"MargenConstruccion V y H_2006.xls"

"MargenConstruccion V y H_2007.xls"

The annual Build Margin emission factor – EF_{BM} obtained are:

Year 2005 BM: **0.3169** tCO₂/MWh

Year 2006 BM: **0.2996** tCO₂/MWh

Year 2007 BM: **0.2923** tCO₂/MWh

Baseline emissions factor - EF

Applying a 0.5 weight for both the operating margin and the build margin, the combined margin emission factors obtained are:

Year 2005 CM: **0.3417** tCO₂/MWh

Year 2006 CM: **0.3111** tCO₂/MWh

Year 2007 CM: **0.2689** tCO₂/MWh

The utilized weights remain fixed throughout the first crediting period, according to the methodology.

Electricity supplied by the project activity to the grid - EG

The Monitoring Report (version November 5th, 2008) shows the following Table 3 indicating monthly energy generation from La Vuelta and La Herradura, for each year of Verification Period. The DOE has verified that these data correspond exactly to the hourly measurements registered in the meters of the commercial frontiers, and reported by EEPDM to XM according to procedures indicated in 3.3.1.1a). Electricity generated by La Vuelta and La Herradura plants (EG) of numeral 3.3.1 Conformity between the Monitoring Plan with Monitoring methodology.

Table 3. Electricity supplied by the project activity to the grid - EG

Year	Month	Net Generation of the plants (MWh)		
		La Vuelta	La Herradura	Total
2005	January	3,736.524	6,390.428	10,126.952
	February	4.774	5,392.112	5,396.886
	March	121.968	5,153.654	5,275.622
	April	6,213.548	11,231.726	17,445.274
	May	7,819.614	12,774.564	20,594.178
	June	7,161.199	12,379.488	19,540.687
	July	6,200.562	12,217.414	18,417.976
	August	4,763.066	5,633.782	10,396.848
	September	4,240.584	7,874.268	12,114.852
	October	7,874.100	12,286.550	20,160.650
	November	6,375.500	10,492.000	16,867.500
	December	2,738.760	12,877.190	15,615.950
Total		57,250.199	114,703.176	171,953.375
2006	January	5,283.300	10,752.006	16,035.306
	February	4,536.114	5,206.252	9,742.366
	March	3,863.882	10,188.508	14,052.390
	April	2,985.746	8,563.236	11,548.982
	May	-	7,548.458	7,548.458
	June	-	10,206.768	10,206.768
	July	4,736.094	10,830.909	15,567.003
	August	3,044.866	6,172.518	9,217.384
	September	4,145.570	6,933.367	11,078.937
	October	4,077.084	11,609.357	15,686.441
	November	5,540.151	12,722.425	18,262.576
	December	4,636.435	12,454.201	17,090.636
Total		42,849.232	113,188.002	156,037.234
2007	January	5,227.993	11,325.359	16,553.352
	February	2,823.392	6,325.903	9,149.295
	March	4,536.269	7,123.777	11,660.046
	April	5,113.109	12,234.135	17,347.244
	May	3,796.519	9,363.904	13,160.423
	June	4,817.362	9,009.661	13,827.023
	July	4,818.065	13,272.711	18,090.776
	August	1,315.352	12,824.374	14,139.726
	September	6,008.707	10,251.439	16,260.146
	October	1,967.636	8,881.541	10,849.177
	November	5,326.619	11,209.353	16,535.972
	December	4,746.523	12,244.190	16,990.712
Total		50,497.538	124,066.335	174,563.873

Emission reductions – ER

As already accepted, in this case neither project emissions, nor leakage emissions are considered, so the emission reduction corresponds to Baseline Emissions Factor (EF) times the electricity supplied by the project activity to the grid (EG), with the results showed in Table 4 Emissions Reduction:

Table 4. Emission Reductions:

	2005	2006	2007	Total
EMISSION REDUCTIONS (tCO₂e)	58,756	48,535	46,940	154,232

Based on the studies carried out and analyzed, presented in this Verification Report (version November 5th, 2008), ICONTEC was able to determine that La Vuelta and La Herradura hydroelectric plants, during the crediting period, from January 1st, 2005 to December 31st, 2007 showed a reduction of 154 232 tons CO_{2e}.

The DOE carried out the comparison of actual generation during the period from January 1st, 2005 to December 31st, 2007 with the estimation of 171 953 MWh (2005), 156 037 MWh (2006) and 174563 MWh (2007). We found an important difference of the emission reductions in comparison of the estimate emission reductions, and it was necessary establish a request for clarification to the owner of the project (CR 6).

3.4 Accuracy of Emission Reduction Calculations

Regarding the measurement record and storage, this is based on the procedures for data transmission and recording of the Wholesale Power Market.

Calibration of energy equipments follows national standards, according to the calibration instructive specified in Colombian standard NTC 4 856 for electricity metering devices, designed to establish the routine essays to be performed on energy meters in order to do initial and periodic verification of meters operation. The methodology and procedures are applied to alternating current active energy meters manufactured according to NTC 2 288, 2 147, and 4 052 standards, and to reactive energy meters manufactured according to NTC 2 148 and 4 569 standards. EE.PP.M 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). Similar procedures apply to all thermal plants in Colombia.

3.5 Quality of Evidence to Determine Emission Reductions

EEPPM provided evidence of maintenance and calibration of the equipment of La Vuelta and La Herradura Hydroelectric plants, as well as data collection and analysis which allows ICONTEC to rely on the information and data presented during the verification.

Internal technical verifications are made to the operation of La Vuelta and La Herradura Plants by interdisciplinary teams, which ensure an appropriate control of power generation, and there also are detailed preventive plans for electrical, electronic and mechanical maintenance of the plant that assure its reliability. The Scheduled Maintenance of electrical, electronic and mechanical components equipment of the plant was carried out by the Division of Power Generation.

3.6 Management System and Quality Assurance

EEPPM is implementing a Quality Management System in the project, and its structure guarantees that documentation and records are within a control scheme ensuring reliability of the information provided during the verification.

Within the EEPPM internal Audits Program, Power Generation Division was included in an Internal Audit, and was conducted by the Quality and Process Direction.

The owner of the project defined that Data will be stored until 2 years after the end of the crediting period or 2 years after the last issuance of CERs, whichever happens later.

4. PROJECT SCORECARD

The conclusions on this scorecard are based on the Monitoring report.

Risk Areas		Conclusions			Summary and findings and comments
		Baseline Emissions	Project Emissions	Emissions Reductions	
Completeness	Source coverage / Boundary definition	✓	✓	✓	All the relevant areas are covered by the monitoring plan and the boundaries of the project are defined correctly and transparently.
Accuracy	Physical Measurement and analysis	✓	✓	✓	The technology is applied in an appropriate manner.
	Data calculation	✓	✓	✓	The emissions reductions are calculated correctly.
	Data Management & Reporting	✓	✓	✓	An eligible data management system is in place.
Consistency	Changes in the	✓	✓	✓	Results are consistent

	project				with underlying raw data.
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5. VERIFICATION STATEMENT

Reporting period: From 2005 01 01 to 2007 12 31

Verified emissions in the above reporting period:

Emission reductions: 154 232 tons of CO₂ equivalents.

5.1 Introduction

ICONTEC has been engaged by Empresas Públicas de Medellín E.S.P. the owner of Project to examine the greenhouse gas (GHG) emission reductions reported from the La Vuelta and La Herradura hydroelectric plant for the corresponding period, equating to 154 232 tons of CO₂ equivalent.

We consider that the project's GHG emissions and resulting GHG emissions reductions reported in the Monitoring Report of November 5th, 2008 are fairly stated.

5.2 Responsibilities of EPPM Project Management and ICONTEC

The owner of the La Vuelta and La Herradura Hydroelectric Project is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project's Monitoring and Verification Plan.

The owner of La Vuelta and La Herradura Hydroelectric project is responsible for developing and keeping records and reporting procedures in accordance with the Monitoring plan.

In a planned way we got the information and asked for explanations we deemed necessary to provide enough evidence that the amount of GHG emission and the calculation of the GHG emission reductions, based on the Monitoring Report, are fairly stated for the reporting period.

5.3 Basis for GHG Verification Opinion

Our verification approach was based on the Kyoto Protocol requirements, Marrakech Agreement, as well as those defined by the CDM Executive Board.

It is our responsibility to set an independent GHG verification opinion on the GHG emissions from the project and approved baseline for the same period.

ICONTEC approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate them. Our examination includes assessment, on a test basis, of evidence relevant to the amounts and disclosures in relation to the project's GHG emission and the calculations of GHG emission reductions for this reporting period.



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5.4 Opinion

ICONTEC is able to certify that the emission reduction from the La Vuelta and La Herradura Hydroelectric Project during the period from January 1st, 2005 to December 31st, 2007 equals to 154 232 tons of CO2 equivalent.

Bogotá D.C., January 5th, 2009

Fabio Tobón
Executive Director
ICONTEC

6. REFERENCES

- /1/ PDD registered version 6
- /2/ Monitoring Plan Annex of the PDD
- /3/ Validation report REV 2 2006 10 23, DVN report
- /4/ Monitoring Report Version September 2008
- /5/ Regulation documents:
 - Order CREG 024 of 1995, by which the commercial aspects are regulated regarding Wholesale Power Market in the national interconnected system which are part of the Operation Regulations.
 - Resolution 3670/2003 Superintendencia de Industria y Comercio. Accreditation of Calibration power and transformers meters labs.
 - Grid Code, Order CREG 025 of 1995
 - Distribution Regulations, Order CREG 070 of 1998
 - Order CREG 006 of 2003, by which the following aspects are adopted: standards on record of commercial frontiers and contracts, information supply and report, and liquidation of commercial transactions in the Wholesale Power Market
 - Ministry of Mines and Energy Order, UPME, official emissions factor.
- /6/ EEPPM Internal Procedures:
 - Instructive to perform on-site power meter proofs with Standard power meter (DIS-EM-LE-IN-009-03) 2006 01 30.
 - Instructive to perform on-site electricity meter proofs with a pattern metering device" (DIS-EM-LE-IN-009-01).
- /7/ Records:
 - Calibration certificate of power meters (N° 23629-1). Laboratory of power meters and transformers calibration. Frontier meter SIEMENS of La Vuelta ref: 83342395. 2004 08 18.
 - Calibration certificate of power meters (N° 23629-1). Laboratory of power meters and transformers calibration. Frontier meter SIEMENS of La Herradura ref: 83342396. 2004 08 18.
 - Calibration certificate of power meters (N° 23629). Laboratory of power meters and transformers calibration. Back-up meter LANDYS La Herradura ref: 77778354. 2004 08 18.
 - Calibration certificate of power meters (N° 23628). Laboratory of power meters and transformers calibration. Back-up meter LADYS La Vuelta ref: 77778378. 2004 08

18.

- Calibration certificate of power pattern (N° 1706). EEPPM's Laboratory of power and gas meters calibration. Portable calibration equipment N° 17 makes MTE – EMH, On-site bench. 2007 11.
- Calibration certificate of power pattern (N° 6006). EEPPM's Laboratory of power and gas meters calibration. Calibration equipment N° 06 makes ZERA, Laboratory bench. 2003 11.
- Calibration certificate of power pattern (N° 6010). EEPPM's Laboratory of power and gas meters calibration. Calibration equipment N° 06 makes ZERA, Laboratory bench. 2007 11.

/8/ - Validation and Verification Manual – UNFCCC Secretariat



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Annex 1

Periodic Verification Checklist

VERIFICATION OF THE LA VUELTA Y LA HERRADURA HYDROELECTRIC PROJECT

TABLE 1: DATA MANAGEMENT SYSTEM/CONTROLS

The project operator's data management system/controls are assessed to identify reporting risks and to assess the data management system's/control's ability to mitigate reporting risks. The GHG data management system/controls are assessed against the expectations detailed in the following table. A score is assigned as follows:

- Full - all best-practice expectations are implemented.
- Partial - a proportion of the best practice expectations is implemented
- Limited - this should be given if little or none of the system components is in place.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including <i>Forward Action Requests</i>)
A. Defined organizational structure, responsibilities and competencies		
A.1. Position and roles <i>Position and role of each person in the GHG data management process is clearly defined and implemented, from raw data generation to submission of the final data. Accountability of senior management must also be demonstrated.</i>	Full	All the Roles and Responsibilities of the personnel involved in the project are clearly defined in La Vuelta and La Herradura and EEPPM documents.

Expectations for GHG data management system/controls	Score	Verifiers Comments (including <i>Forward Action Requests</i>)
<p>A.2. Responsibilities <i>Specific monitoring and reporting tasks and responsibilities are included in job descriptions or special instructions for employees.</i></p>	Full	All the Roles and Responsibilities of the personnel involved in the project are clearly defined in La Vuelta and La Herradura and EEPPM documents.
<p>A.3. Competencies needed <i>Competencies needed for each aspect of the GHG determination process are analyzed. Personnel competencies are assessed and training program implemented as required.</i></p>	Full	All the personnel involved in the Project are competent for carry out the activities. In particular the competence of the maintenance and calibration personnel was verified.
B. Conformance with monitoring plan		
<p>B.1. Reporting procedures <i>Reporting procedures should reflect the monitoring plan contents. Where deviations from the monitoring plan occur, the impact of this on the data is estimated and the reasons justified.</i></p>	Full	The Monitoring Report that was presented, which had to be aligned with the Monitoring Plan, is consistent with the presentation of data taken and the documents control, according to the internal procedures of the company.
<p>B.2. Necessary Changes <i>Necessary changes to the monitoring plan are identified and changes are integrated in local procedures as necessary.</i></p>	Full	It is necessary to do changes to the Monitoring Report. But some clarification reports were presented in the Table 4 of this Annex.
C. Application of GHG determination methods		

Expectations for GHG data management system/controls	Score	Verifiers Comments (including <i>Forward Action Requests</i>)
<p>C.1. Methods used</p> <p><i>There is a documented description of the methods used to determine GHG emissions and justification for the chosen methods. If applicable, procedures for capturing emissions from non-routine or exceptional events are in place and implemented.</i></p>	Full	<p>The methodology defined in the PDD is used for calculating the emissions reduction.</p> <p>The methods are supported by the information included in the internal procedure of maintenance and Quality Management System procedures.</p>
<p>C.2. Information/process flow</p> <p><i>An information/process flow diagram, describing the entire process from raw data to reported totals is developed.</i></p>	Full	<p>Procedures and records, needed to describe the whole plant operation and the way in which the different parameters are measured, have been developed. In the Monitoring Report the description of the process is included (See Table 4 CR1).</p>
<p>C.3. Data transfer</p> <p><i>Where data is transferred between or within systems /spreadsheets, the method of transfer (automatic / manual) is highlighted - automatic links/updates are implemented where possible. All assumptions and the references to original data sources are documented.</i></p>	Full	<p>The data is saved in the System in magnetic files or in hard disks and also in physical form by the commercialization staff. This data is transferred on the website page of XM (www.xm.com.co).</p> <p>All data sources are clearly referenced (See Table 4 CR2).</p>
<p>C.4. Data trails</p> <p><i>Requirements for documented data trails are defined and implemented and all documentation is physically available.</i></p>	Full	<p>Documentation is available and although it has restricted access for recording, it can be verified at the intranet system and also in physical documents. There are internal procedures for document control, Measurement and analysis of data.</p>
<p>D. Identification and maintenance of key process parameters</p>		

Expectations for GHG data management system/controls	Score	Verifiers Comments (including <i>Forward Action Requests</i>)
<p>D.1. Identification of key parameters</p> <p><i>The key physical process parameters that are critical for the determination of GHG emissions (e.g. meters, sampling methods) are identified.</i></p>	Full	All parameters are defined and supported by the internal documentation.
<p>D.2. Calibration/maintenance</p> <p><i>Appropriate calibration/maintenance requirements are determined.</i></p>	Full	<p>Maintenance and verification of the equipment used in the measurements are carried out periodically. And there is a calibration program for the power meter and a maintenance program. (See Table 4 CR 4)</p> <p>The Electromechanical team of EEPPM carries out the periodical preventive maintenance to the equipment and the infrastructure of the La Vuelta and La Herradura hydroelectric Plants.</p>
E. GHG Calculations		
<p>E.1. Use of estimates and default data</p> <p><i>Where estimates or default data are used, these are validated and periodically evaluated to ensure their ongoing appropriateness and accuracy, particularly following changes to circumstances, equipment etc. Validation and periodic evaluation of this are documented.</i></p>	Full	<p>In accordance with the defined PDD all calculations can be done (See Table 4 CR 5).</p> <p>The frontier SIEMENS power meter used for the project has the number 83342395 and 83342396.</p>

Expectations for GHG data management system/controls	Score	Verifiers Comments (including <i>Forward Action Requests</i>)
<p>E.2. Guidance on checks and reviews</p> <p><i>Guidance is provided on when, where and how checks and reviews are to be carried out, and what evidence needs to be documented. This includes spot checks by a second person not performing the calculations over manual data transfers, changes in assumptions and the overall reliability of the calculation processes.</i></p>	Full	All the procedures are implemented in the La Vuelta and La Herradura Plants. The EEPPM is implementing the Quality Management System in the La Vuelta and La Herradura project (See Table 4 CR3).
<p>E.3. Internal verification</p> <p><i>Internal verifications include the GHG data management systems, to ensure consistent application of calculation methods.</i></p>	Full	<p>The Electromechanical team of EEPPM carries out the periodical preventive maintenance to the equipment and the infrastructure of the La Vuelta and La Herradura Hydroelectric Plant.</p> <p>Periodic inspections and measurements are carried out by Operational area which ensures reliable measurements.</p>
<p>E.4. Internal validation</p> <p><i>Data reported from internal departments should be validated visibly (by signature or electronically) by an employee who is able to assess the accuracy and completeness of the data. Supporting information on the data limitations, problems should also be included in the data trail.</i></p>	Full	<p>Internal verification reports and all the technical records related to the operational activities of the plant have been signed by qualified personnel under supervision of the Chief and the top management, which demonstrates their commitment to the project.</p> <p>Internal quality audit was carried to the project in order to establish the effective implementation of the procedures and quality controls.</p>

Expectations for GHG data management system/controls	Score	Verifiers Comments (including <i>Forward Action Requests</i>)
<p>E.5. Data protection measures</p> <p><i>Data protection measures for databases/spreadsheets should be in place (access restrictions and editor rights).</i></p>	Full	<p>There is control of the project data records and the key information of the processes is kept with confidentiality. There is an internal procedure documents and records control. They keep a back up of the data records.</p>
<p>E.6. IT systems</p> <p><i>IT systems used for GHG monitoring and reporting should be tested and documented.</i></p>	Full	<p>It is used for the project equipments, which is automatically managed from a console, and collection of performance data of the Plant is being adjusted in order to do it on-line.</p>

TABLE 2: GHG CALCULATION PROCEDURES AND MANAGEMENT CONTROL TESTING

Identification of potential reporting risk	Identification, assessment and testing of management controls	Areas of residual risks
<p>Due of the calculated emission reductions are lower than those estimated in the PDD was necessary explain the main reasons in the new version of the MR. However, this is a summary of the reasons:</p> <p>Lower energy generation of the plants due to:</p> <ul style="list-style-type: none"> - Lack of generation because of the maintenance activities (corrective and preventive), switching of mechanic parts, and 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 no allow the connection to the interconnected system. - Lack of generation due to river currents dragging leaves and branches that clog the entry filters of the system, thus reducing 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 years 2005, 2006 and 2007. 	<p>The preventive maintenance is established in the company by minimise the impact of the generation process.</p> <p>The Electromechanical team and Power Generation areas of EEPPM carries out the periodical program of operational and maintenance to the equipment and the infrastructure of the La Vuelta and La Herradura hydroelectric Plants.</p>	<p>There are no areas of residual risk</p>

TABLE 3: DETAILED AUDIT TESTING OF RESIDUAL RISK AREAS AND RANDOM TESTING

Areas of residual risks	Additional verification testing performed	Conclusions and Areas Requiring Improvement (including <i>Forward Action Requests</i>)
There are no areas of residual risk.	A cross checking of data logged by remote data measurement to online data will be improved.	<p>EEPPM shall continue development preventing maintenance program rigorously to guarantee the permanent energy generation during next years of crediting period.</p> <p>The Electromechanical team and Power Generation areas of EEPPM carries out the periodical program of operational and maintenance to the equipment and the infrastructure of the La Vuelta and La Herradura hydroelectric Plants.</p>

TABLE 4 RESOLUTION OF CORRECTIVE ACTION AND CLARIFICATION REQUESTS

Draft report clarifications and corrective action requests by Verification team	Ref. to checklist question in Table 1.	Summary of project owner response	Verification team conclusion
<p>CR 1.</p> <p>Data reported in PDD on installed capability, flow and hydraulic head of the centrals do not match with those of the equipment currently installed.</p>	<p>C.2</p>	<p>Project Owner Response:</p> <p>(Refer to pages 3 to 4 of Monitoring Report for further information)</p> <p>The difference between reported operative data and design data is because turbines manufacturers put in the nameplates the information at laboratory conditions where the equipment is calibrated. At operative level data are adjusted to the environmental conditions of the place where the generation plants are to be installed.</p>	<p>Verification Team Response</p> <p>The Monitoring report was modified and now the data is consistent with the actual operational configuration.</p> <p>Verification Team Conclusion.</p> <p>Close</p>
<p>CR 2.</p> <p>In section 5 “Monitoring Plan Implementation” (page 7) of the Monitoring report, second paragraph, the description presented about the management of power generation measurements is not accurate.</p>	<p>B.2 C.3</p>	<p>Project Owner Response:</p> <p>(Refer to page 8 of Monitoring Report)</p> <p>This part is clarified by adding a better description:</p> <p>The power plants La Vuelta and La Herradura belong to the Metropolitan Area under the “<i>Subgerencia Operación (Operation Manager)</i>” of the “<i>Gerencia Generación Energía (Power Generation Manager)</i>” 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 “<i>Equipo de Medida</i>” (Measurement Team) is in charge of taking the measurements. The Measurement Team</p>	<p>Verification Team Response</p> <p>The Monitoring report was modified and now the data is consistent with the actual operational configuration.</p> <p>Verification Team Conclusion.</p> <p>Close</p>



Draft report clarifications and corrective action requests by Verification team	Ref. to checklist question in Table 1.	Summary of project owner response	Verification team conclusion
		<p>is responsible for reporting to XM about 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 software.</p> <p>Once the information is uploaded, a file is created: cr41/mes/día.TXT and it is send to XM. The codes assigned by XM to this project are:</p> <p>EVLT1001 LA VUELTA EHRD1001 LA HERRADURA</p> <p>And in these codes are the official data reported to XM.</p>	

Draft report clarifications and corrective action requests by Verification team	Ref. to checklist question in Table 1.	Summary of project owner response	Verification team conclusion
<p>CR 3. In the Monitoring Report:</p> <p>In Table 2 “Data for Baseline Emissions Calculation” in the paragraph named “Quality control and quality assurance” there is an error in the last date of the meter calibration (August 2008).</p> <p>Resides, there is an inconsistency in making reference to a file “zip-file” in which “Calibration protocols” are included.</p> <p>The final item of this paragraph is titled “Maintenance of meters” but it does not refer to the maintenance itself but to a verification done to the meters.</p>	<p>B.2 D.2</p>	<p>Project Owner Response:</p> <p>(Refer to page 9 or MR)</p> <ol style="list-style-type: none"> 1. The calibration done at the lab before installing the equipment was done in 2004 and the calibration done in-situ was in February 2008. 2. The calibration protocols were attached to this response for your convenience in a folder named “Calibration Protocols”. 3. The procedure named “maintenance of meters” in the previous version of the MR is now included as part of the verification procedures done to the meters, not as a different procedure. 	<p>Verification Team Response</p> <p>The Monitoring report was modified in order to do consistent the information data of the La Vuelta and La Herradura hydroelectric plants.</p> <p>Verification Team Conclusion.</p> <p>Close</p>
<p>CR 4. In Table 2 of the Monitoring report, part 3 “Build Margin emission factor (BM) different formulae are presented from those set in the PDD and the methodology; and in part 4 “Operating Margin emission factor (OM)” the formulae applied are not included.</p>	<p>B.2 E.1</p>	<p>Project Owner Response:</p> <p>(Refer to pages 10, 14 to 17 of MR)</p> <p>Formulae ref. emission factors calculations were moved from Table 2 of the MR and included as a new sub-section 7.1 <i>Calculation of Combined Margin Grid Emission Factor (CM)</i>, in Section 7. FORMULAS USED FOR CALCULATION OF EMISSION REDUCTIONS of the MR to make it</p>	<p>Verification Team Response</p> <p>The Monitoring report was modified in order to do consistent the calculation methodology with the PDD and Methodology applied.</p> <p>Verification Team Conclusion.</p>

Draft report clarifications and corrective action requests by Verification team	Ref. to checklist question in Table 1.	Summary of project owner response	Verification team conclusion
		easier to read and understand.	Close
<p>CR 5.</p> <p>In sections 7 and 8 of the Monitoring report there is not reference to how the calculation formulae were applied or to the application of emission factors and their sources.</p>	<p>B.2 E.2</p>	<p>Project Owner Response:</p> <p>(Refer to pages 14 to 17 of MR)</p> <p>A new Section 7.1 showing how the calculation of the BM, OM and CM was done is included in this new version.</p>	<p>Verification Team Response</p> <p>The Monitoring report was modified and now includes the calculation formula according with the PDD and the Methodology.</p> <p>Verification Team Conclusion.</p> <p>Close.</p>
<p>CR 6.</p> <p>The total calculation of emissions reduction for the period 2005, 2006 and 2007 has an amount lower than the estimation defined in the PDD (Table 9).</p>	<p>E.2</p>	<p>Project Owner Response:</p> <p>(Refer to page 16 of the MR)</p> <p>The reasons why the calculated emission reductions are lower than those estimated in the PDD are explained in the new version of the MR. However, this is a summary of the reasons:</p> <ul style="list-style-type: none"> • Lower energy generation of the plants. • Different grid emission factors which are lower than the factor used in the PDD estimate. 	<p>Verification Team Response</p> <p>The Monitoring report was modified and now includes the explanation about the reasons of the estimated emissions reduction are not achieved.</p> <p>Verification Team Conclusion.</p> <p>Close</p>

CR: Clarification Request; **CAR:** Corrective Action Request; **FAR:** Forward Action Request