Monitoring report form
(Version 03.1)

Monitoring report

Title of the project activity	Santa Ana Hydroelectric Plant
Reference number of the project activity	0275
Version number of the monitoring report	3
Completion date of the monitoring report	20/12/2013
Registration date of the project activity	11/05/2006
Monitoring period number and duration of this monitoring period	Monitoring period #7 (01/08/2011 - 31/07/2012)
Project participant(s)	Empresa de Acueducto y Alcantarillado de Bogotá (EAAB – ESP) EDF Trading Limited MGM Carbon Portfolio, S.a.r.l.
Host Party(ies)	Colombia
Sectoral scope(s) and applied methodology(ies)	1: Energy industries (renewable - / non-renewable sources). AMS-I.D. Ver. 7 - Renewable electricity generation for a grid.
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	20,642 tCO_{2e}
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	10,801 tCO_{2e}

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The city of Bogotá has three principal sources of drinking water: Tibitoc, La Regadera, and Chingaza. The treated water flow at the Chingaza system is conducted through an alternate tunnel named Usaquén, which leads the treated water from the Wiesner treatment plant, located in La Calera, to Santa Ana and Suba tanks, located in north of Bogotá, and others small storage tanks in the city through Rosales tunnel.

In order to take advantage in height difference between the Wiesner treatment plant and Santa Ana water tank, as well as the water flow delivered to the city through the Santa Ana and Suba control structures, Santa Ana Hydroelectric Plant was built between the years 2001 and 2003..

The power plant was designed to turbine a water flow of 13.5 m^3/s, has an installed capacity of 13.43 MW and a net head of 105.9 m, which could generate 90 GWh/year. However, the reduction in water demand of the city, the implementation of different measures to increase efficiency in its use, as well as measures to ensure the required water supply for the city, have reduced energy generation expectations which is estimated today between 30 GWh/year and 48 GWh /year.

The power generated by Santa Ana Hydroelectric Plant is fed to the national interconnected system of Colombia in accordance to power market regulations and environmental and operational authorizations. A key objective of the project is to reduce greenhouse gas emissions from the grid.

It began operations in June 2005 and operates continuously until today. Its CDM crediting period of 10 years started in August 2005. For the seventh year of the crediting period the plant generated and delivered 24.6 GWh/year to the national interconnected system of Colombia, reducing 10,801 tCO_{2e}.

A.2. Location of project activity

The Santa Ana Hydroelectric Plant is located at north east of Bogotá city, Colombia, at coordinates:
110,324.65 North
105,849.56 East.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host)	Public entity: Empresa de Acueducto y Alcantarillado de Bogotá (EAAB – ESP).	No
United Kingdom of Great Britain and Northern Ireland.	Private entities: EDF Trading Limited. MGM Carbon Portfolio, S.a.r.l.	No
Switzerland	Private entity: MGM Carbon Portfolio, S.a.r.l.	No

A.4. Reference of applied methodology

The following approved baseline and monitoring methodology was applied to the project activity:

AMS-I.D “Renewable electricity generation for a grid” Version 7.

No additional methodologies or tools were applied

A.5. Crediting period of project activity

01/08/2005 – 31/07/2015 (Fixed)

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

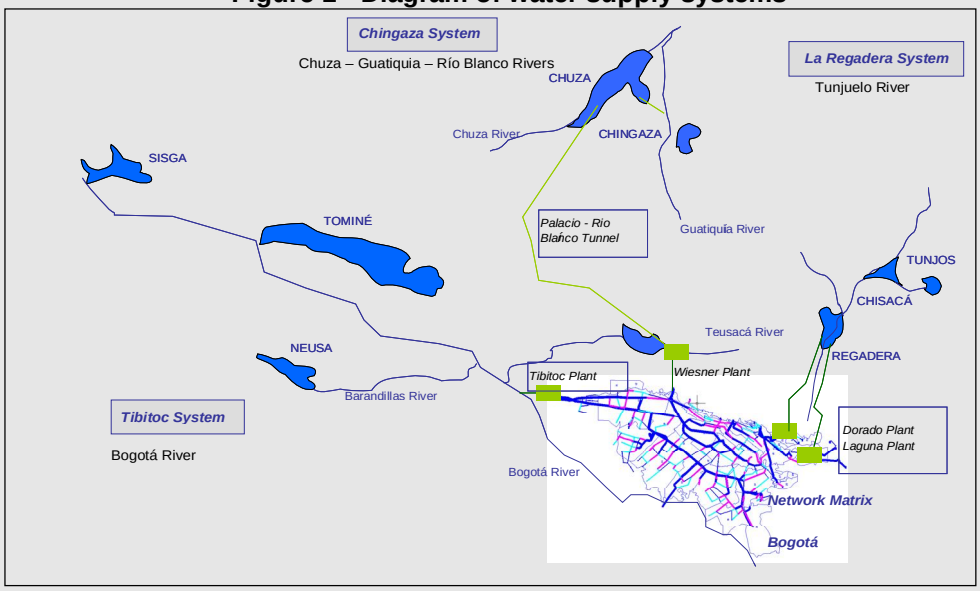
Context

The water system available to Bogotá City also supplies some surrounding municipalities: in the north, Gachancipá, Tocancipá, Sopó, Cajicá, Chia and Cota`s industrial area; in the east, La Calera; in the west, Funza, Madrid and Mosquera; in the south, Soacha.

The population served is close to 8 million people, representing nearly 1,898,000 users and require an average daily flow of 15 m³/s approximately. The three main systems that supply water to Bogotá City and surrounding municipalities are:

Chingaza System (east), associated with the Francisco Wiesner treatment plant.
Tibitoc System (north), associated with the Tibitoc treatment plant.
The Regadera System (south), associated with El Dorado, Vitelma and Laguna treatment plants, the last two used as a contingency endorsement.

Figure 1 - Diagram of water supply systems



The eastern supply system (Chingaza system) is located northeast of the city at the top of the east mountain range. It comprises the Chuza reservoir, some catchment wells (Blanco river system) and the San Rafael reservoir, which receives water from the Chuza reservoir through an overflow structure located before entering the treatment plant, so as a minimum input from Teusacá River's upper basin.

The Chuza reservoir, which mainly regulates the flow of Guatiquía and Chuza rivers, is conducted at the treatment plant through a tunnel system which initiates conduction of water pressure and then by regulating a flow control valve, passes to a free flowing condition. San Rafael reservoir is used during contingency periods, when there is suspension of supply from the Chuza reservoir, especially during inspection and maintenance operations between Chuza reservoir and treatment plant. The treatment plant of this system is called Francisco Wiesner, whose output supplies approximately 70% of total demand.

The northern supply system comprises Bogota river and a group of reservoirs that allow the regulation flow of this river and the Aposentos's reservoir that regulates the Teusacá river`s flow (downstream). The water collected by pumping is treated at the Tibitoc plant, whose output supplies approximately 28% of total

demand.

The southern supply system is formed by a group of reservoirs that regulate Tunjuelo river's flow upper basin. The treatment plants associated with this system are: El Dorado, Vitelma and La Laguna. The last two are used as a contingency endorsement. The output of this system supplies approximately 2% of total demand[1].

Table 1 - Storage capacity and treatment of the water supply systems

Supply System	Reservoirs (millions of m^3)		Treatment Plants (m^3/s)	
Tibitoc	Tominé	690	Tibitoc	10.5
	Sisga	102		
	Neusa	102		
	Aposentos	0.8		
Chingaza	Chuza	257	Francisco Wiesner	14
	San Rafael	75		
La Regadera	Chisacá	6.7	El Dorado	1.6
	La Regadera	3.3	La Laguna	0.45
	Los Tunjos	2.4	Vitelma	1.5

Localization

The treated water flow in the Chingaza system is conducted through a tunnel known as Usaquen´s alternate tunnel. It is a conventional concrete covered tunnel, with 2.5 km in length, which leads the treated water from the Wiesner plant, located in La Calera, to the Santa Ana and Suba tanks[2], located in north Bogotá, and to others storage tanks located in center, south east and south west of the city, through Rosales´s tunnel.

In order to take advantage of the difference in available height between the Wiesner plant and the Santa Ana tank, as well as the water flow delivered to the city through the Suba and Santa Ana control structures, was built between the years 2001 and 2003, the Santa Ana Hydroelectric Plant[3].

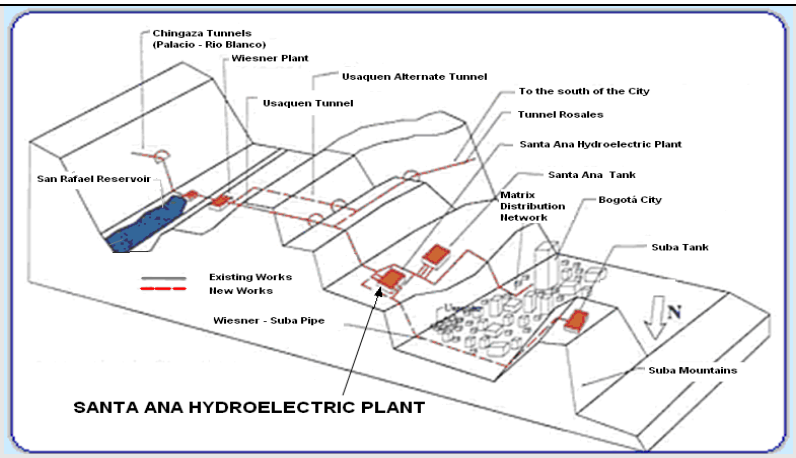
The Santa Ana Hydroelectric Plant began operations on June 10th, 2005 but its crediting period started on August 1th, 2005. It is located in northern Bogotá, at 119th street at top east, in the place known as “Santa Ana Complex”.

The feeding flow for the Suba and Santa Ana control structures[4], in normal operation is approximately 70% of treated flow at the Wiesner plant, which corresponds to 55% of the city demand, and provides the aqueduct service to the north, north east and north west of Bogotá.

The water flow that is normally transported is used by the plant to produce electric energy delivered into the national interconnected grid through local distribution system.

Figure 2 - Location of the Santa Ana hydroelectric plant

[1] The Yomasa treatment plant is also considered as part of the southern supply system that captures water from a creek that bears its name and has a treatment capacity of 0.025 m^3/s.
[2] The storage capacity of Santa Ana tank is 30,000 m^3 and Suba tank is 90,000 m^3.
[3] According to the dimensions defined by the Agustin Codazzi Geographical Institute (IGAC), Wiesner plant is located exactly at 2,795 meters above sea level and the tank in Santa Ana to 2,679 meters above sea level. The height of the turbine shaft is at 2,674 meters above sea level therefore takes advantage height of 121 m between the Wiesner plant and the turbine.
[4] The flow required by Santa Ana and Suba tanks is normally used by the Santa Ana Hydroelectric Plant to produce electric power. However, when the turbo group is unavailable (in the event of failure, low flow or maintenance) the flow will be conducted automatically by a multijet valve installed in a parallel pipe. In the event that the turbo group and multijet valve are unavailable, the flow may be conducted through a derivation of high pressure.



Expected operation

The Santa Ana Hydroelectric Plant was designed to generate around 90 GWh/year, with 13.5 m^3/s water flow, considering the Chingaza System - Wiesner Plant expansion project to treat an approximately 21 m^3/s water flow[5].

However, the reliable generation flow was significantly reduced compared to the design flow of the plant, due mainly to the reduction in the trend of water consumption in the city since the late nineties[6], which was of 17.6 m^3/ s in 1996 to about 15 m^3/s in recent years.

The reduction in city water demand, due to efficiency measures in water use promoted by EAAB, as well as the adoption of measures to ensure the water supply required for the city, reduced the generation expectations of the Santa Ana Hydroelectric Plant to 47 GWh/year approximately.

One of the most important measures taken by EAAB to ensure a reliable supply of water required to meet the demand of the city, an overlapped goal with any other objective, was the Vulnerability Mitigation Program implementation of the water supply systems. This program was designed to identify any potential risks that could affect the drinking water supply to the city. As a part of it the Chingaza Tunnels Maintenance and Coating Program[7], seeks to mitigate as much as possible their risk of detachment, coating the tunnels in conventional concrete[8].

In order to make the coating and maintenance activities of the Chingaza tunnels there has to be a change in the operation of the water supply systems, from a normal operation stage (see Figure 3) to an operation stage that considers the implementation of those activities. Initially, the coating program of the tunnels considered:

- *First*, shutting down each of the Chingaza tunnels for complete inspection and maintenance during a three month period per year. This operation reduces the total flow of drinking water from Chingaza System.
- *Second*, increasing the drinking water supply from the Tibitoc System to compensate the loss of supply from Chingaza System.

During the months established annually to the maintenance of the tunnels, it is necessary to reduce the treated flow provided by the Wiesner plant to the Santa Ana and Suba tanks, limited by the ability of the San Rafael reservoir and operating conditions of the aqueduct system.

[5] EAAB. **Designs for Construction of the Usaquen Alternate Tunnel and Santa Ana Hydroelectric Plant**. Report No. 5. Optimization of the Central. Contract No.1-02-4000-0122-96. Contractor: INGETEC S.A.
[6] EAAB. **Expansion Plan of Water Supply System of the Bogota City and its Neighbor Municipalities**. Report. No. 4. Optimal Dispatch Adjustment of the Plants. Contract No. 2-02-25300-332-2004. Contractor: INGETEC S.A.
[7] The Chingaza tunnels are: Siberia (3 km), Palacio - Blanco River / free flow (10 km), Palacio - Blanco River / under pressure (18.4 km), El Faro (0.97 km). Total: 32.4 km
[8] Ibid. Report No. 3. **Rehabilitation Program, Vulnerability Supply System and Service Life of Assets**.

When considering a scenario of reduced water flow available for generation, below the minimum flow required for operating the Santa Ana Hydroelectric Plant[9], it is expected that during the annual maintenance activities of Chingaza tunnels it is not allowed to operate the hydroelectric plant. As a result of this scheme of operation, it is estimated that over the 10 year term of the Chingaza tunnels maintenance and coating program, the annual generation mean of Santa Ana Hydroelectric Plant will be around the 47 GWh/year[10].

Despite the above, the available flows for generation in the Santa Ana Hydroelectric Plant depend on the magnitude and spatial distribution of potable water demand in Bogota and the optimal release from treatment plants, giving priority to the coverage, quality and security of water service, considering the behavior of water sources, the operation of production systems and water distribution and maintenance requirements of these systems.

Due to maintenance needs and dynamics of proper operation of the water system, covering activities for Chingaza tunnels can be made in one or two periods per year, each period lasting two to three months depending on the backup capacity of San Rafael reservoir and climate factors in the maintenance period (see Figure 4).

By the previous, the projection of electric power generation in the Santa Ana Hydroelectric Plant is being reviewed and are currently estimated that this could be between 30 GWh/year and 48 GWh/year [11].

Figure 3 - Normal operation conditions of the potable water supply systems

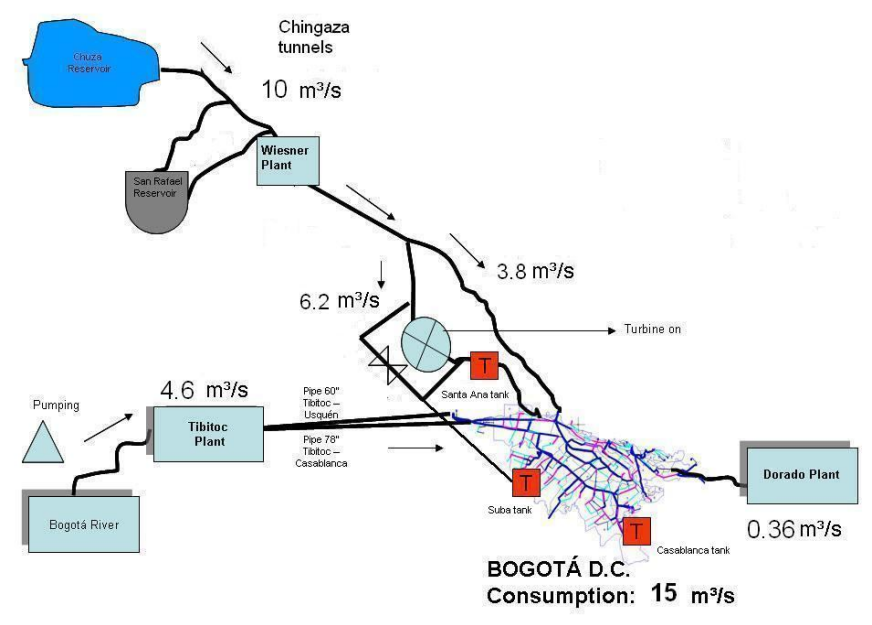
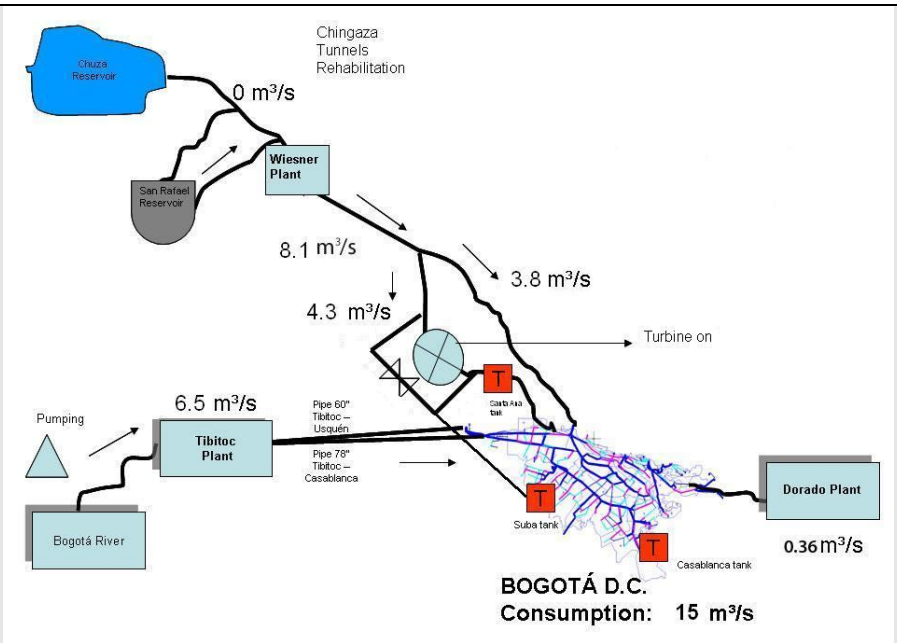


Figure 4 - Operation conditions of the potable water supply systems with maintenance of Chingaza tunnel (time: 70 days)

[9] The Santa Ana Hydroelectric Plant could generate using flows > 3.7 m^3/s and < 5.2 m^3/s but is a special operation in which it is required to control vibrations in the turbo group to approach the cavitation region.

[10] EAAB. **Studies and consultancy for the marketing and launch of operations of the Santa Ana Hydroelectric Plant and to define the optimal release of drinking water, taking into account the plant along with other generation options**. Document No. 2. Study of optimal release aqueduct system including the Santa Ana Plant. Contract No. 2-02-4200-305-2001. Contractor: INGETEC S.A. In the recommendations chapter of this study, it is determine that the probable average annual generation in the Santa Ana Hydroelectric Plant for 10 years of the coating and maintenance of Chingaza tunnels could be around 47 GWh/year and the average flows likely during the maintenance period would be 3.5 m^2/s and in normal operation in 8.6 m^2/s.

[11] EAAB. **Planning Electric power Generation. Period August 2008 - December 2012**. Document prepared by the Network Matrix Aqueduct Direction. 2008. The plan is updated at the beginning of each year as part of the Action Plan of that office.



Actual operation

For the period from 01/08/2011 to 31/07/2012, the average monthly demand for potable water was 15.02 m^3/s approximately , which was produced by water supply systems as follows:

1. Chingaza System: 10.02 m^3/s.
2. Tibitoc System: 4.63 m^3/s.
3. La Regadera System: 0.37 m^3/s.

Under this operation scheme, the Table 2 presents the average monthly entrance flow of the Santa Ana System[12] (flow measured over the finish line to the turbine and that feeds the Santa Ana and Suba control structures and the northeast line).

Table 2 - Monthly average flow of the Santa Ana system

YEAR	MONTH	REGISTERED FLOW (m^3/s)
2011	AUG	6.68
	SEP	6.54
	OCT	6.67
	NOV	7.51
	DEC	7.40
2012	JAN	6.30
	FEB	6.77
	MAR	5.83
	APR	6.21
	MAY	6.63
	JUN	4.74
	JUL	5.65

Source: Control Center. Network Matrix Aqueduct Direction.

As shown in Table 2, the Santa Ana Hydroelectric Plant had throughout the year flow available for

[12] The Santa Ana system is a drinking water pipeline that feeds three derivations: entrance to the Santa Ana tank, entrance to Suba tank and the northeast line. The first two correspond to the average flow available for generation whiles the third not. This is because the northeast line diverts around the 1.5% flow of Santa Ana system and this flow doesn´t go through the turbine because is necessary the Wiesner plant pressure to supply drinking water at the north east area of the city. The flow meter of the Santa Ana system is located between the end of the Usaquén´s alternate tunnel and Santa Ana Hydroelectric Plant.

generation, but this flow not necessarily was conducted through the turbine due to problems in the turbo-generator system or changes in the operational sceneries of the water supply system that prevented the generation, despite the availability of water.

The events that affected the project operation during the seventh year of crediting period were:

1. Damage in electromechanical equipment of the Santa Ana Hydroelectric Plant. Due to damage in the Pratt valve, the power generation was suspended from 11/06/2011 (from 18:00 p.m.) until 15/12/2011. The plant starts operations on 16/12/2011 but had to be suspended again from 21/12/2011 (from 17:56 p.m.) until 28/02/2012. Drawbacks in electromechanical equipment also affected power generation during the months of March and April 2012.

2. Reduced flow from the Wiesner Plant. Due to restrictions on water treatment in Wiesner plant, was necessary to reduce the production rate of 10.5 m^3/s to 9.5 m^3/s and increase the production in the Tibitoc plant of 4.5 m^3/s to 5.5 m^3/s. These movements decreased flow available for generation between 29/02/2012 and 14/03/2012. A further reduction in the production rate of the Wiesner plant affected the power generation from 05/06/2012 to 30/06/2012.

3. Suba Hydroelectric Plant construction. Due to operational movements required in the water system for the Suba Hydroelectric Plant construction, the power generation of Santa Ana Hydroelectric Plant was suspended from 09/06/2012 until 26/06/2012.

4. Change in operating conditions of water system distribution. Due to the closure of the conduction pipeline 69" Usaquén – Santa Lucia, the power generation was reduced between 25/07/2012 and 29/07/2012.

Other events that reduced the generation were intermittent faults occurring on power circuits operated by CODENSA. These unforeseen events left 15 hours in which there was no energy generation for the national interconnected grid.

For all the above, for the seventh year of the project, electric power generation at Santa Ana Hydroelectric Plant was reduced by 48% compared to the estimated annual generation in the Project Design Document (PDD)[13].

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

There are no temporary deviations from registered monitoring plan or applied methodology during this monitoring period.

B.2.2. Corrections

On section D.3 (section B.7.3 on PDD under VVS) Data to be monitored of registered PDD, the channels of authority and responsibility for project monitoring have corrected according to the new operational structure in the company; thus the version of PDD validated and registered contains an outdated description of labour charges with authority and responsibility. The PDD has been corrected by updating in the table of "authority and responsibility roles of monitoring plan" including all entities and persons with responsibility in the project monitoring.
In addition, the company has only one specific procedure related to power generation (MA0407P) and several instructive (MA0407I01, MA0407I02, MA0407I03 and MA0407I04) which are applicable to all energy generation and distribution activities; thus, section D.4 (section B.7.1 on PDD under VVS) of PDD validated and registered has a mistake since there are not exist 21 procedures designed to monitor electricity generation at multiple levels, its delivery to the grid, and cross checking with electricity

[13] The electric power actually generated and delivered to the national interconnected grid during the period August 2010 - July 2011 accounted for 114% of the electric power estimated for the same period in the "Planning of Power Generation," prepared by the Network Matrix Aqueduct Direction.

purchaser, regional distributor and UPME. The PDD has been corrected by updating the QA/QC procedures by changing the number 21 by 1 and explaining the scope of this document.

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

There are no permanent changes from the registered monitoring plan or applied methodologies approved / submitted during this monitoring period.

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

There are no changes to the project design of the project activity approved or submitted during this monitoring period.

B.2.5. Changes to start date of crediting period

There are no changes to the start date of the crediting period.

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

The project does not consider afforestation or reforestation activities.

SECTION C. Description of monitoring system

Technical operation of monitoring

The electric power generated by the Santa Ana Hydroelectric Plant is sent into the national interconnected grid through the local distribution system, according to the contract signed between EAAB – ESP and the operator of the local grid, CODENSA (*Comercializador y Distribuidor de Energía S.A)*[29], in compliance with the provisions made by Resolutions 025 of 1995 and 070 of 1998 of the Energy and Gas Regulatory Commission (CREG)[30].

The administration, operation and maintenance of grid assets, according to the contract signed between EAAB – ESP and CODENSA[31], complies with the CREG Resolutions 003 of 1994, 082 of 2002 and 070 of 1998.

The daily measurement of the electric power generated is realized in Usaquén electrical substation owned by CODENSA, through the energy meters of the commercial frontier (main and backup). These meters meet all technical requirements set by CREG Resolutions 025 of 1995 and 006 of 2003 and the System Manager Exchange Commercial (ASIC) provisions.

The verification and validation of the daily measurement, done through the meters of commercial frontier, is made by EAAB through automatic and electronic interrogation of the two meters (main and backup) located in Usaquén electrical substation owned by EAAB – ESP, which don´t have the formality of registration with the ASIC.

The meters calibration meets all the requirements established in CREG Resolutions 070 of 1998 and 006 of 2003 and the Colombian Technical Standard NTC - ISO/IEC 17025.

The single line diagram of the Santa Ana Hydroelectric Plant (see Figure 1) shows the main line driving the

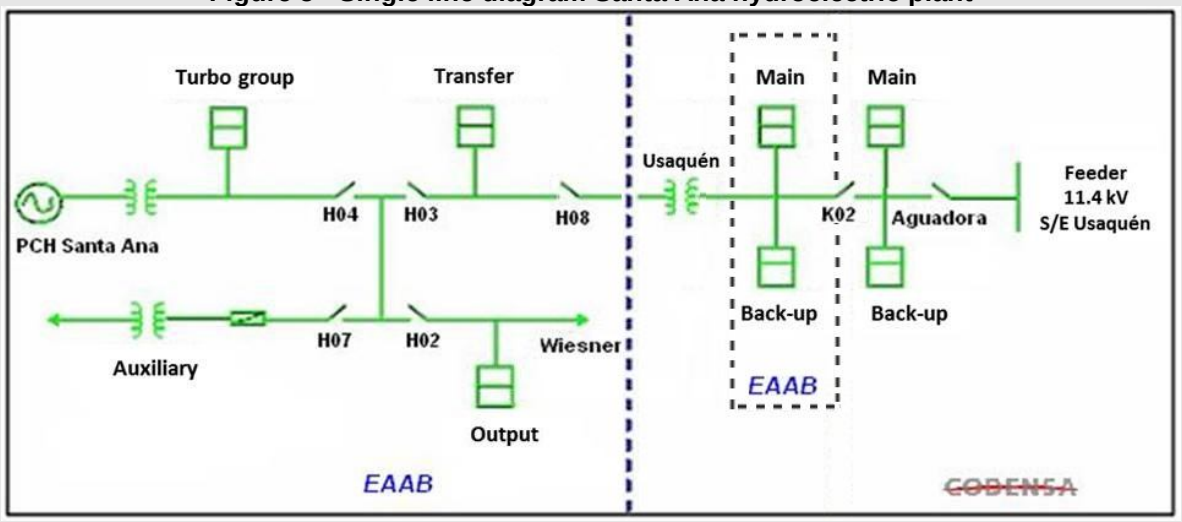
[29] EAAB. Contract No. 9-99-25400-566-2004. Object: "Establish the scope of the commitments and responsibilities of the parties, connecting the Santa Ana Hydroelectric Plant to the local distribution system of CODENSA as well as set the parameters and terms and criteria to govern legal relations management and commercial skills of the contracting parties stages of testing commissioning and commercial operation of the pre-mentioned connection and define the commitments and responsibilities regarding the replacement maintenance and ownership of the assets of connecting parts". Duration: 25 years.

[30] The Electric Power and Gas Regulatory Commission is the Colombian authority that regulates the sector of electric power and gas.

[31] EAAB. Contract No. 1-99-26300-812-2009. Objet: "Set the annual compensation that EAAB will pay to CODENSA for the management, operation and maintenance services (AOM) of connection assets owned of the latter and forming part of the electrical connection system of Santa Ana Hydroelectric Plant to CODENSA´s SDL and set CODENSA´s obligations in relation with AOM of these assets". Completion date: 24/12/2012. It is expected to automatic renewal.

electric power generated from the plant to the commercial frontier power meter, which is delivered to the interconnected national grid. The two additional lines showed, are output energy lines: one to provide energy to the auxiliary services of the hydroelectric plant, and the other one, as an emergency line to supply energy to the Wiesner Plant. In none of the cases, the control system allows importation of energy from another grid that could be counted as electric power generated by the Santa Ana Hydroelectric Plant[32].

Figure 5 - Single line diagram Santa Ana hydroelectric plant



The electric power generated by the Santa Ana Hydroelectric Plant is commercialized by EMGESA[33] *(Empresa Generadora de Energía Eléctrica S.A.)*, acting as a representative of the plant in the Wholesale Power Market of Colombia, as part of the marketing contract signed with EAAB[34].

As small plant began commercial operations on June 10, 2005[35] after the official registration of the commercial frontier in the ASIC[36] (Experts Market - XM), with an effective capacity of 8 MW under the following characteristics[37]:

SIV CODE	METER SERIAL NUMBER[38]	EXPORTER	IMPORTER	VOLTAGE LEVEL (kV)	METER CLASS	CR	START
ESNT 1001	30031	EMGESA	CODENSA	11.4	0.2	CR21	2005-06-09

Due to the change of commercial frontier meters, is updated registration information[39]:

SIV CODE	METER SERIAL NUMBER	IF	EF	VOLTAGE LEVEL (kV)	METER CLASS	CR	REGISTRY
ESNT 1001	102013561	EEB1	SNT1	11.4	0.2S	CR3F	2011-09-03

[32] The Clause 12 of the connecting contract for operation of the Santa Ana Hydroelectric Plant No. 9-99-25400-566-2004 signed on December 23, 2004 between the EAAB and the grid operator, CODENSA, expressed regarding new connections that "The EAAB-ESP cannot connect in parallel to the assets of connection object this contract, the grid that goes to the Wiesner Plant, unless the Wiesner Plant is disconnected from the La Calera Electrical Substation. It is also considered an emergency condition that must be informed to the Local Dispatch Center (LDC) of CODENSA S.A. E.S.P. and coordinated by the latter, following the rules of operation to assure the disconnection power from La Calera Electrical Substation. No other grid can be connected to the assets to this contract. If the EAAB – ESP fail to fulfill this part of the contract, CODENSA, assumes that the EAAB-ESP terminates the contract and will proceed to disconnect the connection point previously assigned".

[33] Electric Power Generating Company.

[34] Contract No. 1-99-26300-0530-2009. Objet: "Acquisition by EMGESA S.A E.S.P. of all the energy generated by Santa Ana Hydroelectric Plant owned by EAAB". Duration: 2 years and 7 months. Start date: 01/09/2009 to 30/04/2012 and Contract No. 1-10-26300-0842-2011. Objet: "Acquisition by EMGESA S.A. E.S.P. of all the energy generated by Santa Ana, Suba, Usaquen and Ventana Hydroelectric Plants owned by EAAB". Duration: 10 years. Start date: 01/05/2012 to 30/04/2022

[35] The period from 10 June to31 July 2005, corresponds to the period of testing and adjustments.

[36] XM is a company of ISA that is created in 2005, responsible for managing the ASIC and the CND (Dispatch National Center). It provides operation, administration and development services of the Wholesale Power Market of Colombia.

[37] Communication No. 010916-1 from ISA to EMGESA, dated 09/06/2005.

[38] For XM registration process is required to send calibration certificates of the main and support meters. But as a matter of registering and consultation procedure, XM only refers to the main meter.

[39] The communication No. 3014-11-009431-3 from XM to EMGESA, dated 02/09/2011, is the letter that approves the meter change. It is important to note that the registration of a boundary generation is done by the marketer at the start of commercial operations, however the meters that register for the boundary are susceptible of updates and changes must be made official by the marketer in ASIC.

The daily registration of the electric power generation is made by EMGESA, through CAM[40] (*Compañía Americana de Multiservicios*), with information obtained by the interrogation, automatic and electronic of the commercial frontier meters[41].

The data is recorded by CAM in the ASIC and communicated to both EAAB and CODENSA. This information is analyzed independently by EMGESA, CODENSA and EAAB in accordance with the procedures of verification and validation defined by each entity and by CREG Resolution 006 of 2003. The data that is registered in the ASIC is officially published on the website of XM and corresponds to the electric power measure and delivered to the interconnected national grid through the local distribution system (http://www.xm.com.co/Pages/GestiondelaOperaciondelSIN.aspx).

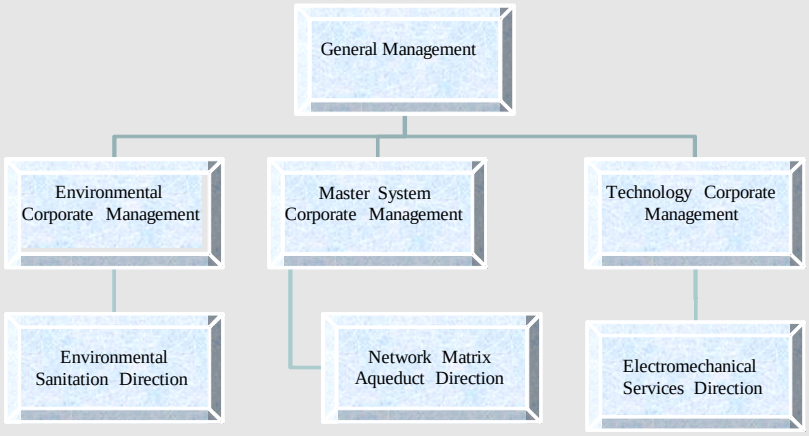
Additionally, the ASIC and other market agents checked once this information is available for consultation in the database NEON, administered by XM[42].

CREG Resolutions 006 and 015 of 2009 regularized confidential handling of the information of wholesale energy market, which lets you know after 3 months, all information of national generation. These resolutions are currently suspended by CREG resolutions 127 and 159 of 2009[43].

Operational and administrative structure

Figure 6 shows the part of EAAB´s organizational structure[44] responsible of the administration, operation, maintenance and monitoring CDM project Santa Ana Hydroelectric Plant, during the seventh year of crediting period.

Figure 6 - Operational and administrative structure Santa Ana hydroelectric plant



As an operating point of the distribution system of the city's drinking water, the Network Matrix Aqueduct Direction is the responsible area for the overall operation of the Santa Ana Hydroelectric Plant, and to execute supervision of the electric power generated in the plant, as part of implementing the quality management system under ISO 9001.

The Network Matrix Aqueduct Direction executes the operating activities of the Santa Ana Hydroelectric

[40] Multi Services American Company.
[41] CAM is a company that provides services to EMGESA for interrogation and recording commercial frontier power meters. Additionally CAM has accredited laboratory in Colombia for the revision of power meters.
[42] NEON database is operated and managed by XM, there are stored all transactions of the Wholesale Power Market of Colombia.
[43] CREG took into account the Resolution No. 18-1654, 2009 issued by the Ministry of Mines and Energy.
[44] EAAB: Agreement 11 of 2007. By means of which is modified the Organizational Structure of Empresa de Acueducto y Alcantarillado de Bogotá - ESP and identify the functions of its dependencies.

Plant considering the planning, operation and maintenance of the water supply systems, as part of an Industrial Agreement signed between the Water Supply and Network Matrix Aqueduct Directions. The Water Supply Direction joins the organization as providing drinking water for the Network Matrix Aqueduct Direction.

The technical and commercial operation related to the process of generating and selling electric power is headed by the Electromechanical Services Direction. This office is responsible for monitoring the electric power generated and delivered to the interconnected national grid.

The scheduled maintenance of electrical, electronic and mechanical components equipment of the plant is headed by the Electromechanical Services Direction. This maintenance is part of a service agreement signed between the Network Matrix Aqueduct Direction and the Electromechanical Services Direction.

The tracing of the CDM component project is headed by the Environmental Corporate Management Office, through Environmental Sanitation Direction, which is responsible for preparing the monitoring report with the support of the Electromechanical Services and Network Matrix Aqueduct Directions.

Procedures for quality assurance

The quality management system, which includes electric power generation activities, is certificated under ISO 9001:2008, with the following scope: "*Planning, Design and Construction Management, Operation, Control and Maintenance of Water Utility Systems for the Conduction and Distribution of Drinking Water in Mains Pipes and Clean Development Mechanism (CDM) Management for the Main Water System*".

During period 2011 – 2012, there were several activities related to implementation of quality management system:

A. Planning process

In January of 2011 and 2012, the Network Matrix Aqueduct Direction defined the Action Plan of the respective year, in order to plan their activities. That document included the aspects to be taken to the issue of electric power generation. In 2012, it included an adjustment to the electric power generation planning for the year.

B. Business operations processes

The procedures and instructions listed in Table 3 consider all activities related to power generation and comply with standard numerals NTC ISO 9001:2008.

Table 3 – Energy generation processes

Macroprocess	Process	Procedures	Directions	Format
Service Aqueduct	Distribution and Control of Main pipelines	Procedure MA0407P - Electric power generation.	Instructive MA0407I01 – Start-up and operation of small hydroelectric plant.	MA0407F04 -Data comparison.
			Instructive MA0407I02 - Measurement and data analyses.	
			Instructive MA0407I03 -Load rejection.	
			Instructive MA0407I04 - Results reconciliation.	

C. Resource management processes

1) Information management. For preparation and updating all documents of quality management system the following procedure was applied:

Macroprocess	Process	Procedure
EE Management Strategy	**EE03** Planning and documentation management system.	**EE0302P** Process documentation.

2) Document management**.** Generated records The registry were filed following the procedure:

Macroprocess	Process	Procedure
FI Information and Knowledge Management	**FI02** Document management.	**FI0203P** Flow and documentary record.

3) Control of Measurement Equipments**.** The control of measurement equipments has been made according to the procedure:

Macroprocess	Process	Procedure
MA Service Aqueduct	**MA04** Distribution and Control Matrix Pipelines.	**MA0417P** Control of electric power generation measurement equipments.

D. Continuos improvement process.

1) Customer's care and satisfaction management**.** Satisfaction surveys were conducted to Environmental Corporate Management, because this area receives the information for monitoring the draft Clean Development Mechanism, and to the Electromechanical Services Direction as the area that manages the marketing of the electric power generated by the plant. The following procedure was applied:

Macroprocess	Process	Procedure
CE Evaluation, Improvement and Prevention	**CE02** Continuos improvement.	**CE0202P** Customer satisfaction.

2) Non-compliance treatment. In order to follow up non-compliant of electric power generation, attended the procedure:

Macroprocess	Process	Procedure
CE Evaluation, Improvement and Prevention	**CE02** Continuos improvement.	**CE0203P** Non-compliance treatment.

3) Management system measurement. Continued the calculation of electric power generation indicator, which allows up to generation; generation income; the issuance of Certified Emission Reductions (CER) and revenues from marketing of such certificates. Monthly in meetings for monitoring the action plan and indicators are analyzed the indicators results, according with the procedure:

Macroprocess	Process	Procedure
CE Evaluation, Improvement and Prevention	**CE01** Management system evaluation	**CE0102P** Management system measurement.

4) Internal Audit. During the period under review the internal audit was carried out following the procedure:

Macroprocess	Process	Procedure
CE Evaluation, Improvement and Prevention	**CE01** Management system evaluation	**CE0101P** Internal audit.

In November 2011, ICONTEC conducted the certification audit in order to maintain the scope of quality management system under ISO 9001:2008. The certification was upheld.

The authority and responsibility roles

The authority and responsibility roles that were identified for different aspects associated with the monitoring of electric power generation data are presented in Table 4.

Table 4 - Authority and responsibility roles of monitoring plan

Activity		Authority	Responsibility
Measurement	Internal	Electromechanical Services Office Director	Plant Operator / Energy negotiator
	External	EMGESA	CAM
Registration	Internal	Electromechanical Services Office Director	Plant Operator / Energy negotiator
	External	EMGESA	CAM
Verification	Internal	Electromechanical Services Office Director	Control Center Chief/ Energy negotiator
	External	XM EMGESA CODENSA	CAM CODENSA EMGESA
Report	Internal	Electromechanical Services Office Director	Control Center Chief/ Energy negotiator
	External	EMGESA	CAM
Calibration and maintenance	Internal	Electromechanical Services Office Director	Control Center Chief/ Energy negotiator
	External	EMGESA CODENSA	CAM

Data collection

The instructive MA0407I02 “Measurement and Data Analysis" presents the monitoring instructions of the electric power generated and delivered daily by Santa Ana Hydroelectric Plant to the national interconnected grid.

- ✓ **Measurement**

The daily measurement of power generated and delivered to the grid is performed as follows:

EMGESA through CAM (subcontractor) performs the interrogation (continuous) of the power meter located at the commercial frontier in the Usaquén electrical substation (at the buyer side), owned by CODENSA, in accordance with CREG Resolution 006 of 2003 and contractual requirements.

In addition, CAM has a group of readers (personnel who attend operations at field) which acts when there are failures in telemetry systems of the meters. To avoid the loss of data, the meters have a mass internal memory which stores generation information up to 60 days. To access the information, CAM applies their internal procedure TM-PR-08.

At the same time, technical personnel of EAAB performs the automatic and electronic interrogation of the power meter located in the Usaquén electrical substation (at the seller side), owned by EAAB, using JEAMREAD software.

Note: In case of emergency during monitoring (e.g. loss of communication, failure of some power meter, among other) at the buyer side, the reading of the frontier power meters (main and back up) would be performed by technical personnel of CAM at the project site by manual reading using an optical reader and a laptop to submit the information in accordance with provisions of the Resolution CREG 006 of 2003. In case of complete failure of the buyer power meters, the readings would be taken from the power meters (main and back up) located at the seller side (either manually read or telemetry). For both cases, the readings would be compared with historical information to validate values (taken the most conservative).

- ✓ **Registration**

Once the commercial frontier meter is interrogated, EMGESA performs the following activities, accordance with the CREG Resolution 006 of 2003:

- Recording daily generation data on the website of XM (Experts Market) – www.xm.com.co
- Sending daily generation data trough email to EAAB. This information is sent every 24 hours.

Once the meter owned by EAAB is interrogated, EAAB performs the following activities:

Recording daily generation data on electronic format MA0407F04 “Data Comparison”.

✓ **Verification**

Every 24 hours, EAAB performs the verification of the daily generation data through the comparison of data from the meter owned by EAAB and data from the commercial frontier meter sent by EMGESA. This comparison is performed in the format MA0407F04-01 “Data Comparison”.

If the daily generation data obtained from the interrogation of the meter owned by the EAAB does not have a deviation greater than 5% compared to generation data obtained by EMGESA, through the commercial frontier meter, the data delivered and registered by EMGESA on website of XM is validated by EAAB.

Additionally, every six days, the EAAB can verify whether the daily generation data provided by EMGESA and validated by the EAAB correspond to the data recorded by EMGESA on website of XM, accordance with the CREG Resolution 006 of 2003. This verification can be realized after three months if CREG lift the suspension of Resolutions 006 and 015, 2009.

If the deviation between the data reported by EMGESA and the data obtained by the EAAB is greater than 5% or if the data reported by EMGESA and validated by the EAAB not correspond to those recorded on website of XM, follow the instructive MA0407I04 "Reconciliation of Results", accordance with the CREG Resolution 006 of 2003. After the conciliation process, EMGESA records the daily generation data on website of XM.

Finally, the EAAB verifies and validates that the daily generation data reported by EMGESA in the website of XM correspond to generation data that are listed in the monthly report that provides EMGESA to the EAAB, which relates the amount of energy generated, fees and costs of the period (15th of every month).

✓ **Report**

The report of electric power generated and delivered daily by the Santa Ana Hydroelectric Plant to the national interconnected grid correspond to the data officially registered and available for consultation on the website of XM.

Based on this report is calculated the emissions reduction of CO_2e of Santa Ana Hydroelectric Plant applying the emission factor of the national interconnected grid, 0.4392 kg CO_2e per KWh.

The Table 5 presents the KWh generated and delivered monthly to the national interconnected grid of Colombia and the respective CO_2e emissions reduced during the period 01/08/2011 – 31/07/2012.

Table 5 - Electric power delivered to the national interconnected grid and estimation of CO_2e emissions reduced (August 01-08-2011 – July 31-07-2012)

YEAR	MONTH	ELECTRIC POWER (MW/h)	EMISIONS REDUCED (tCO_2e)
2011	AUG	4,006	1,759
	SEP	3,792	1,666
	OCT	3,533	1,552
	NOV	644	283
	DEC	656	288

2012	JAN	0	0
	FEB	1	0
	MAR	1,864	819
	APR	2,389	1,049
	MAY	3,600	1,581
	JUN	1,230	540
	JUL	2,879	1,264
Total		24,593	10,801

E. Control and attention of non-predicted episodes

To prevent the occurrence of non-predicted episodes the company has a general procedure to perform a preventive maintenance service to all electromechanical equipment (including the power plant Santa Ana).

Macroprocess	Process	Procedure
M4 Maintenance management	**M4FM** Electromechanical Maintenance.	**M4FM0101** Electromechanical preventive maintenance.

To attend the situation due to non-predicted episodes, the company has a general procedure to perform a corrective maintenance service to all electromechanical equipment (including the power plant Santa Ana).

Macroprocess	Process	Procedure
M4 Maintenance management	**M4FM** Electromechanical Maintenance.	**M4FM0102** Electromechanical corrective maintenance.

SECTION D. Data and parameters

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

Data / Parameter:	Emission factor of the national interconnected grid of Colombia.
Unit:	$kgCO_2e$ /KWh.
Description:	Emission coefficient calculated in a transparent and conservative manner as the average of the “approximate operating margin” and the “build margin
Source of data:	Resolution 181421 of 2005 issued by Ministry of Mines and Energy of Colombia.
Value(s) applied):	0.4392
Purpose of data:	Used for calculation of baseline emissions.
Additional comment:	Not applicable.

D.2. Data and parameters monitored

Data / Parameter:	KWh generated and delivered daily to the national interconnected grid of Colombia.
Unit:	KWh.
Description:	Amount of electricity generated and delivered to the interconnected national grid of Colombia.
Measured/ Calculated / Default:	Measured.
Source of data:	Daily records of ccommercial frontier meter, located in the Usaquén electrical substation, owned by CODENSA.
Value(s) of monitored	See worksheet: *CO_2e Emissions Reduction Santa Ana Hydroelectric*

parameter:	*Plant (01-08-2011 to 31-07-2012). Xls*
Monitoring equipment:	1) Electric power meters of commercial frontier localized in Usaquén electrical substation, owned by CODENSA: • Manufacturer: AMETEK • Type: JEMSTAR. • Model: JS-09R6010-CO. • Accuracy class: 0.2S. • Serial number: main meter No. 102013561; supporting meter No. 102013562. • Calibration certificates: Meter No. 102013561: CAM-IM1010-020007 issued on 27/10/2010. Meter No. 102013562: No CAM-IM1010-020003 issued on 26/10/2010. • Tests performed at the Meters Laboratory of CAM, as per the Colombian Technical Standard NTC 4856. • Tests performed: start; accuracy; constant verification; operation without charge. • Test results: conform. 2) Electric power meters for direct measurement of EAAB – ESP, localized in Usaquén electrical substation, owned by EAAB – ESP: • Manufacturer: AMETEK. • Type: JEMSTAR. • Model: JS-09R6010-31. • Accuracy Class: 0.2S. • Serial number: main meter No. 14600821; supporting meter No. 14600822. • Calibration certificates: Meter No. 14600821: CAM-IM1003-001400 issued on 16/03/2010. Meter No. 14600822: CAM-IM1004-002887 issued on 15/04/2010. • Tests performed at the Meters Laboratory of CAM, as per the Colombian Technical Standard NTC 4856. • Tests performed: start; accuracy; constant verification; operation without charge. • Test results: Conform.
Measuring/ Reading/ Recording frequency:	Measuring frequency: Continuous (Automatic in real time) Reading frequency: Daily (data acquisition software) Recording frequency: Aggregated monthly (with annual chance).
Calculation method (if applicable):	_
QA/QC procedures:	Instructive: MA0401I02 “Routine Santa Ana station”. Instructive: MA0417P “Control of electric power generation measurement equipments”. Procedure: MA0407P “Electric power generation” Instructive: MA0407I01 “Start-up and operation of small hydroelectric plant”. Instructive: MA0407I02 “Measurement and data analyses”. Instructive: MA0407I03 “Load rejection”. Instructive: MA0407I04 “Reconciliation of results”.

	Format: MA0407F04 “Data comparison”.
Purpose of data:	Used for calculation of baseline emissions.
Additional comment:	Not applicable.

D.3. Implementation of sampling plan

Not applicable.

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

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

The baseline is the kWh produced by the Santa Ana Hydroelectric Plant multiplied by the emission factor of the national interconnected grid of Colombia (measured in kg CO2 equ/kWh).

The baseline of Santa Ana Hydroelectric Plant uses the official emission factor of national interconnected grid defined in the Resolution 181421 of November 2005, issued by Ministry of Mines and Energy of Colombia: 0.4392 kg CO_2e/kWh.

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

In accordance to the appropriate approved baseline methodology used in this CDM project activity, emissions by sources of GHG due to the project activity are considered to be zero.

E.3. Calculation of leakage

Leakage is to be considered only when transferring existing renewable energy technology from another activity.

The Santa Ana Hydroelectric Plant is not transferring existing renewable energy technology from another activity. The energy conversion equipment for the project was manufactured new for specific site conditions. All of the equipment to be installed in the facility can be clearly tracked by the appropriate manufacturing plates located in the plant, specifying year of manufacture, sourcing and supported by the appropriate existing record related to manufacturing contracts and placement orders with technology suppliers. Therefore there is no leakage associated to the Santa Ana Hydroelectric Plant.

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

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total	10,801	0	0	10,801

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

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period

Emission reductions or GHG removals by sinks (t CO_2e)	20,642	10,801

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

Not applicable.

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

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	119,241	-

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Document information

Version	*Date*	*Description*
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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