MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

CONTENTS

* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

MONITORING REPORT
VERSION 2

SANTA ANA HYDROELECTRIC PLANT
0275

FIFTH PERIOD
01/08/2009 – 31/07/2010

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

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The city of Bogotá relies on three principal sources of drinking water: Tibitoc, La Regadera, and Chingaza.

The treated water flow in the Chingaza system is conducted through an alternate tunnel named Usaquén, which leads the treated water from the Wiesner plant, located in La Calera, to the Santa Ana and Suba tanks, located in north Bogotá, and to others storage tanks of the city, through Rosales tunnel.

In order to take advantage of the difference in available height between the Wiesner plant and Santa Ana tank, as well as the water flow delivered to the city through the Santa Ana and Suba control structures, was built between the years 2001 and 2003, the Santa Ana Hydroelectric Plant[1].

It was designed for turbine water flow of 13,5 m^3/s, has a installed capacity of 13,43 MW and uses a net head of 105,9 m, which could generate 90 GWh/year. However, the reduction in water demand of the city, the result of the implementation of different measures to increase efficiency in its use, as well as measures to ensure the required water supply for the city, reduced expectations generation of the plant and today is estimated at 30 GWh/year and 48 GWh /year.

The electric power generated by the Santa Ana Hydroelectric Plant is sent into the national interconnected grid 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 national interconnected system of Colombia.

It began operations in June 2005 and since then, continuously operates. Its accreditation period CDM of 10 year began on 01/08/2005. For the fifth year of the accreditation period the plant generated and delivered 30,9 GWh/year to the national interconnected grid of Colombia, reducing of this way the emission of 13.582 Ton CO_2e at the atmosphere.

A.2. Project Participants:

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Host Country Party: Colombia.
Authorized Participants: Empresa de Acueducto y Alcantarillado de Bogotá (EAAB).

Other Party involved: United Kingdom of Great Britain and Northern Ireland.
Authorized Participants: EDF Trading Limited and MGM Carbon Portfolio, S.a.r.l.

[1] According to the dimensions defined by the Agustin Codazzi Geographical Institute (IGAC), Wiesner plant is located exactly at 2795 meters about see level and the tank in Santa Ana to 2679 meters about see level. The height of the turbine shaft is at 2.674 meters about see level therefore takes advantage height of 121 m between the Wiesner plant and the turbine.

A.3. Location of the project activity:

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The Santa Ana Hydroelectric Plant is located in northern Bogotá city, Colombia, exactly at coordinates 110324.65 North and 105849.56 East.

A.4. Technical description of the project:

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The main technical characteristics of the Santa Ana Hydroelectric Plant are: net design head 105.9 meters[2]; design flow[3] 13.5 m^3/s; installed capacity 13.43 MW; nominal capacity 12 MW; Francis turbine horizontal axis; rotation speed 600 rpm; synchronous generator; power transformer 15 MW.

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 and the operator of the local grid, CODENSA (*Comercializador y Distribuidor de Energía S.A)*[4], in compliance with the provisions made by Resolutions 025 of 1995 and 070 of 1998 of the Energy and Gas Regulatory Commission (CREG)[5].

The administration, operation and maintenance of grid assets, according to the contract signed between EAAB and CODENSA[6], 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 two energy meters (main and backup). These SIEMENS meters, with serial numbers 30031 and 30029, which meet all technical requirements set by CREG Resolutions 025 of 1995 and 006 of 2003 and the System Manager Exchange Commercial (ASIC) provisions.

The two 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 meter with serial number 30029 have calibration certificate CAM-IM0807-003322, issued on 27/06/2008. The meter with serial number 30031 in review made 15/03/2010 did not meet the tests of accuracy according to certificate CAM-IMNC1003-0003307 so is removed and made the purchase of a new pair of meters, but now owned by EAAB, which meet all current regulations. The biennial review of meter with serial 30029 is suspended pending the acquisition and installation of new meters owned by EAAB. The new meters are installed in November 2010.

The verification and validation of the daily measurement, done through the commercial meters frontier, is made by EAAB through automatic and electronic interrogation of the two AMETEK meters (main and backup) with serial numbers 14600821 and 14600822, JemSTAR model, located in Usaquén electrical substation owned by EAAB .

AMETEK meters do not have the formality of registration with the ASIC but they are under full responsibility of EAAB and have calibration certificates CAM-IM1003-001400 (issued on 16/03/2010) and CAM-IM1004-002887 (issued on 15/04/2010), respectively.

The single line diagram of Santa Ana Hydroelectric Plant (see Figure 1) shows the main line driving the electric power generated from the plant to the commercial frontier power meter, which is delivered to

[2] The net design head 105.9 m is the average operation of the turbine. The maximum net design head is 109.5 m and the nominal net design head is 100 m. The net head is in function of the flow, due to the hydraulic structure loss that depends on the led flow from the Wiesner Plant to Santa Ana Hydroelectric Plant. Additionally, the net head also depends on the downstream pressure turbine imposed by the hydraulic network of the city.

[3] The efficient operation flows are between 5.2 m^3/s and 13.5 m^3/s.

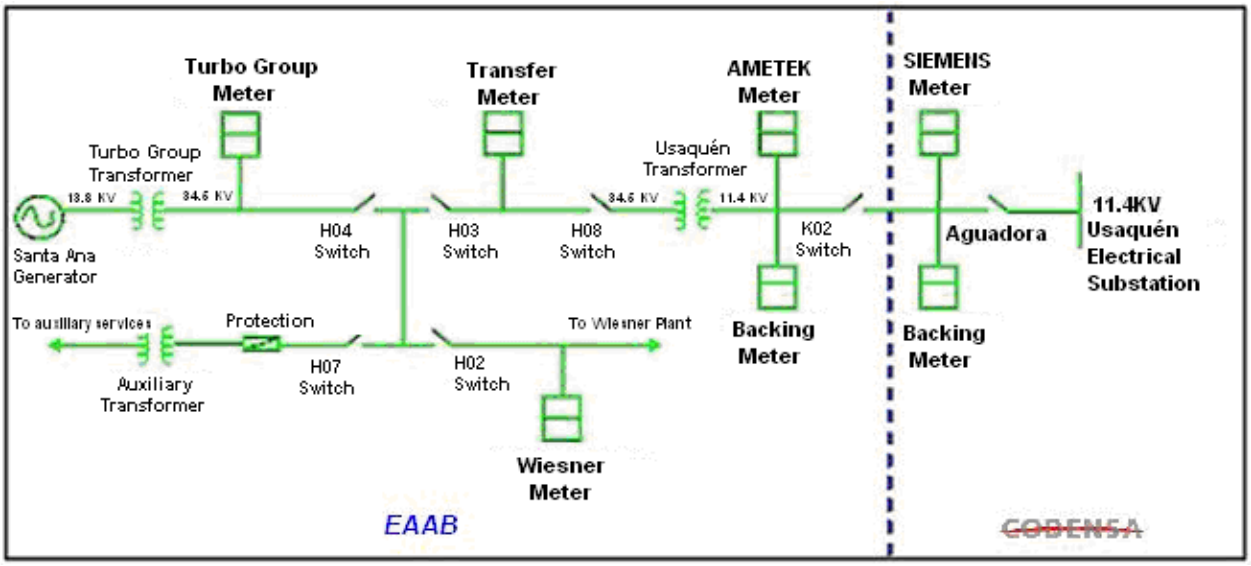
[4] EAAB. Contract No. 9-99-25400-566-2004. Duration: 25 years.

[5] The Electric power and Gas Regulatory Commission is the Colombian authority that regulates the sector of Electric power and Gas.

[6] EAAB. Contract No. 1-99-26300-894-2008. Duration: 1 year. Contract No. 1-99-26300-812-2009. Duration: 1 year.

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[7].

FIGURE 1
SINGLE LINE DIAGRAM SANTA ANA HYDROELECTRIC PLANT



The electric power generated by the Santa Ana Hydroelectric Plant is commercialized by EMGESA[8] *(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[9].

As smaller plant began commercial operations on June 10, 2005,[10] after the official registration of the commercial frontier in the ASIC, with an effective capacity of 8 MW under the following characteristics[11]:

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

CR: Collection Center (where the meter data are reported)

[7] 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 lant, 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".

[8] Electric Power Generating Company.

[9] EAAB. Contract No. 1-99-26300-671-2005. Start date: 01/12/2005. Completion date: 30/08/2009. Contract No. 1-99-26300-0530-2009. Start date: 01/09/2009. Completion date: 31/03/2012.

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

[11] Communication No. 010916-1 from ISA to EMGESA, dated June 9, 2005.

The daily registration of the electric power generation is made by EMGESA, through CAM [12] (*Compañía Americana de Multiservicios*), with information obtained by the interrogation, automatic and electronic, of the commercial frontier meters[13].

The data is recorded by CAM in the ASIC (Experts Market - XM) [14] 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://sv04.xm.com.co/neonweb).

Additionally, the ASIC and other market agents checked once this information is available for consultation in the database NEON, administered by XM[15].

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, 2009, due to Ministry of Mines and Energy considerations regarding the planned natural gas rationing and the presence of the climatic phenomenon "El Niño".

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

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Baseline methodology:

AMS-I.D. Ver. 7. Renewable electric power generation for a grid.

"The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2 equ/kWh) calculated in a transparent and conservative manner as the average of the "approximate operating margin" and the "build margin", where:

(i) The "approximate operating margin" is the weighted average emissions (in kg CO2 equ/kWh) of all generating units serving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

(ii) The "build margin" is the weighted average emissions (in kg CO2 equ/kWh) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20 per cent of existing plants, or the 5 most recent plants".

The result of applying this methodology is the emission factor of the national interconnected grid, 0.4392 Kg CO_2e/Kwh. This factor was officially registered and validated in the PDD of CDM project Santa Ana Hydroelectric Plant and corresponds to the official emission factor of the national interconnected grid of Colombia defined by the Ministry of Mines and Energy by Resolution 181421 of 2005.

[12] Multi Services American Company.

[13] 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.

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

[15] NEON database is operated and managed by XM, there are stored all transactions of the Wholesale Power Market of Colombia.

Monitoring methodology:

According to Appendix B of the Simplified M&P for Small-Scale CDM Project Activities, monitoring shall consist of metering the electric power generated by the renewable technology and applying the grid emissions factor for small scale projects of this category.

A.6. Registration date of the project activity:

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Registration date: 11/05/2006.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

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Crediting period: 10 years.
Start date: 01-08-2005.

A.8. Name of responsible person(s)/entity(ies):

>>

The responsible persons for completing the monitoring report form (CDM-MR) are:

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SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity:

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Context

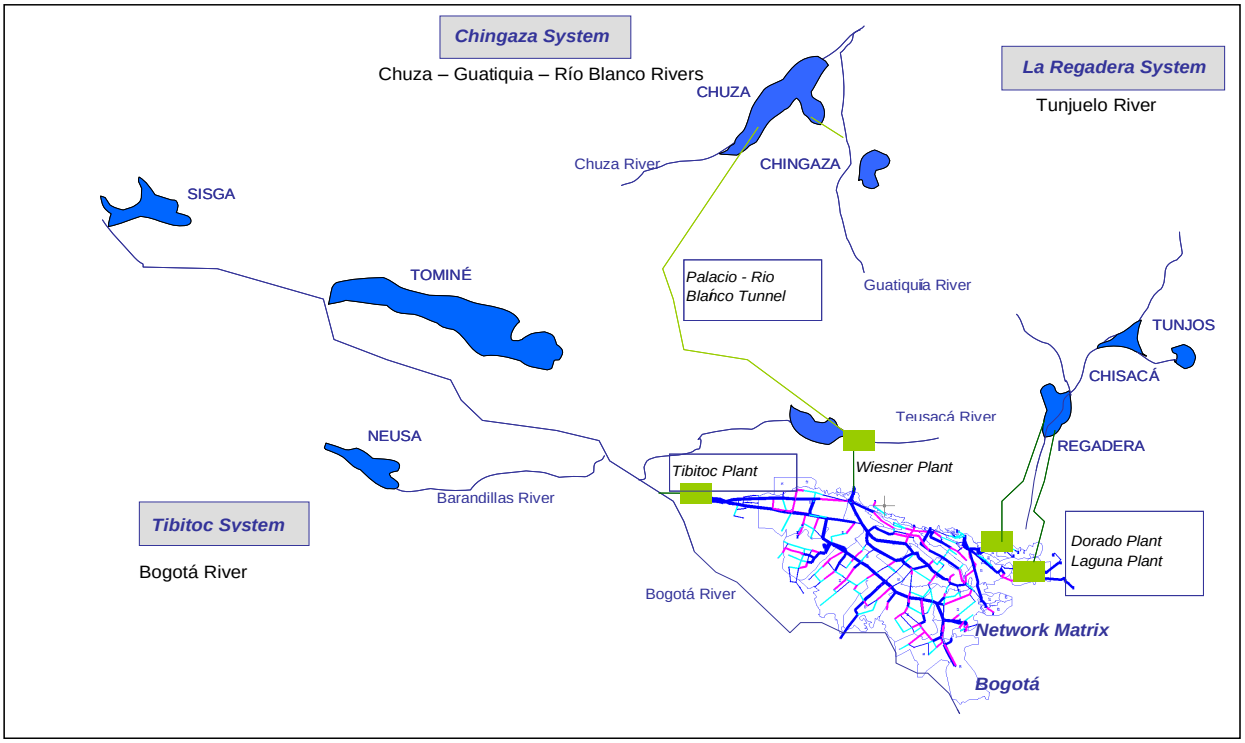
The water system available to Bogotá City also supplies some surrounding municipalities: in the north, Gachancipá, Tocancipá, Sopó, Cajicá, Chia and Cota`s industrial area; in the east, La Calera; in the west, Funza, Madrid and Mosquera; in the south, Soacha.

The population served is close to 8 million people, representing nearly 1.600.000 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 2
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[16].

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

Description of the project

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[17], located in north Bogotá, and to others storage tanks located in center, south east and south west of the city, through Rosales´s tunnel.

[16] 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.

[17] The storage capacity of Santa Ana Tank is 30,000 m^3 and Suba Tank is 90,000 m^3

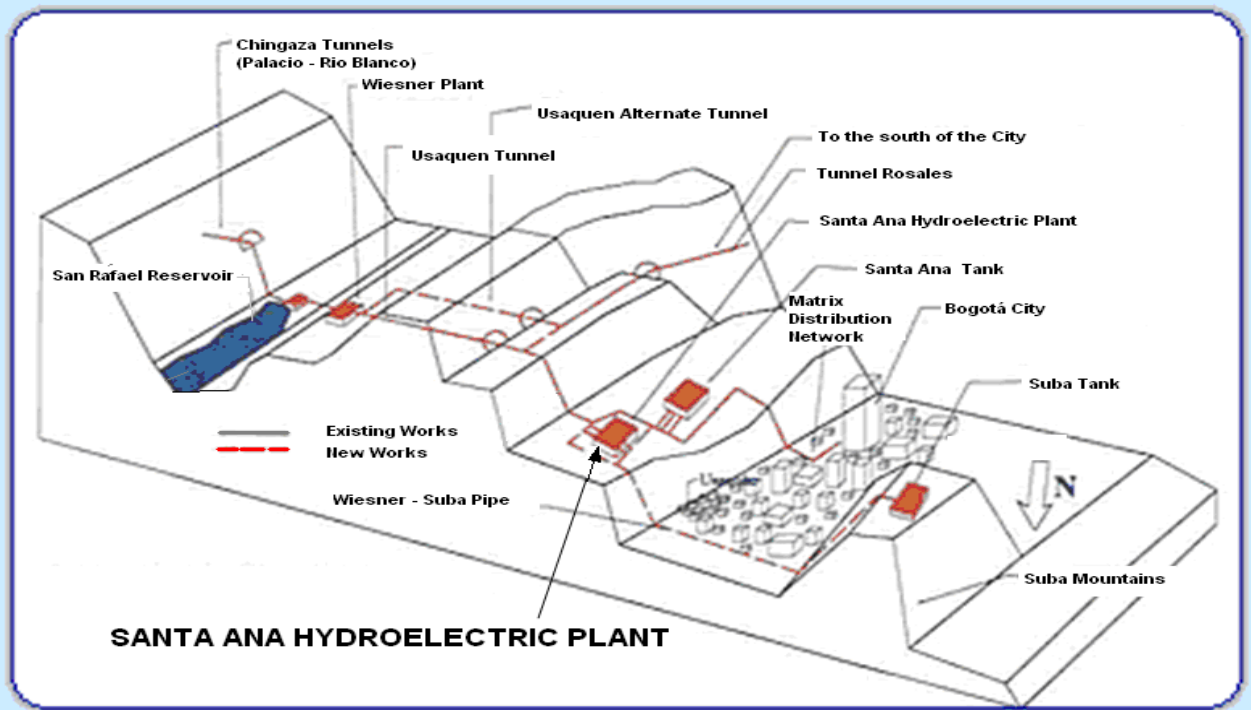
In order to take advantage of the difference in available height between the Wiesner plant and Santa Ana tank, as well as the water flow delivered to the city through the Suba and Santa Ana control structures, was built between the years 2001 and 2003, the Santa Ana Hydroelectric Plant[18].

The Santa Ana Hydroelectric Plant is located in northern Bogotá, at 119th street at top east, in the place known as "*Santa Ana Complex",* exactly at coordinates 110324.65 North and 105849.56 East.

The feeding flow for the Suba and Santa Ana control structures[19], 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 3
LOCATION OF THE SANTA ANA HYDROELECTRIC PLANT



Expected operation of the project

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[20].

[18] According to the dimensions defined by the Agustin Codazzi Geographical Institute (IGAC), Wiesner plant is located exactly at 2795 meters about see level and the tank in Santa Ana to 2679 meters about see level. The height of the turbine shaft is at 2.674 meters about see level therefore takes advantage height of 121 m between the Wiesner plant and the turbine.

[19] 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.

[20] 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.

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[21], 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[22], seeks to mitigate as much as possible their risk of detachment, coating the tunnels in conventional concrete[23].

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 4) 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 three 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.

When considering a scenario of reduced water flow available for generation, below the minimum flow required for operating the Santa Ana Hydroelectric Plant[24], 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[25].

Despite the above, the available flows for generation in the Santa Ana Hydroelectric 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

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[21] 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.

[22] 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

[23] Ibid. Report No. 3. **Rehabilitation Program, Vulnerability Supply System and Service Life of Assets**.

[24] 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.

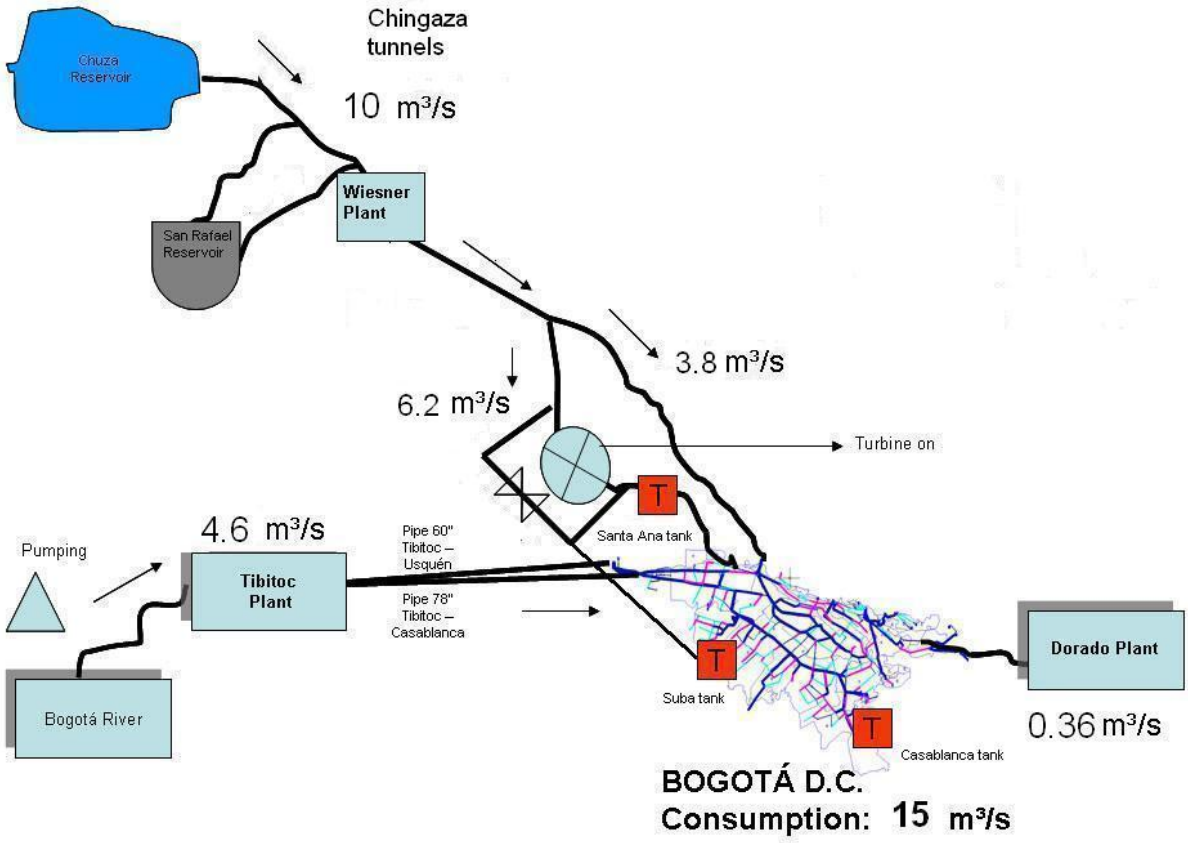
[25] EAAB. **Studies and consultancy for the marketing and launch of operations of the Santa Ana Hydroelectric Plant and to define the optimal release of drinking water, taking into account the plant along with other generation options**. Document No. 2. Study of optimal release aqueduct system including 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.

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 5).

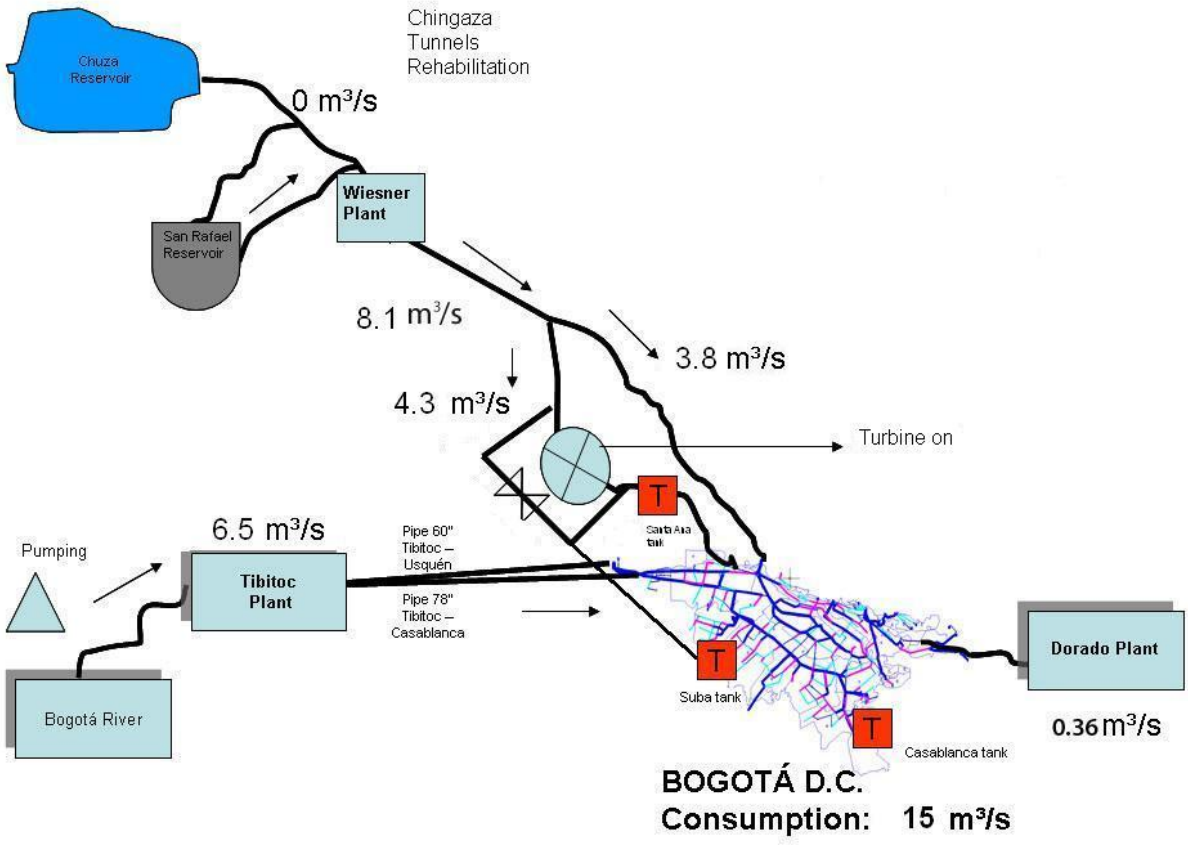
By the previous, the projection of electric power generation at Santa Ana Hydroelectric Plant is being reviewed and are currently estimated that this could be between 30 GWh / year and 48 GWh / year [26].

FIGURE 4
CONDITIONS NORMAL OPERATION WATER SUPPLY SYSTEMS



[26] 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.

FIGURE 5
CONDITIONS OPERATION WATER SUPPLY SYSTEMS
MAINTENANCE AND COATING CHINGAZA TUNNELS (TIME: 70 DAYS)



Actual operation of the project

For the period from 1/08/2009 to 31/07/2010, the average monthly demand for potable water was 15 m^3/s approximately, which was produced by water supply systems as follows:

1. Chingaza System: 9,9 m^3/s.
2. Tibitoc System: 4,7 m^3/s.
3. La Regadera System: 0,36 m^3/s.

Under this operation scheme, the Table 2 presents the average monthly entrance flow of the *Santa Ana System*[27] (flow measured over the finish line to the turbine and that feeds the Santa Ana and Suba control structures and the northeast line).

[27] 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 while 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 alternate tunnel and Santa Ana Hydroelectric Plant.

TABLE 2
MONTHLY AVERAGE FLOW OF THE SANTA ANA SYSTEM

YEAR	MONTH	REGISTERED FLOW (m^3/s)
2009	AUG	5,79
	SEP	6,1
	OCT	6,41
	NOV	6,91
	DEC	6,87
2010	JAN	5,47
	FEB	6,04
	MAR	5,83
	APR	4,99
	MAY	5,75
	JUN	7,7
	JUL	7,8

Source: Control Center. Network Matrix Aqueduct Direction.

As shown in Table 2, the Santa Ana Hydroelectric Plant had throughout the year flow available for 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 fifth year of accreditation period were:

1. Chingaza tunnels maintenance, by the Water Supply Direction.

   In 2009, Chingaza tunnels maintenance was implemented in two periods [28]. The first maintenance was conducted between 13/11/2008 and 19/01/2009. The second maintenance took place between 19/07/2009 and 17/09/2009. During the last maintenance, the Wiesner plant operated pumping San Rafael reservoir and its production rate decreased 1,0 m^3/s, reducing in proportion the flow goes to the Santa Ana system. This water flow was compensated by Tibitoc plant.

   In 2010, Chingaza tunnels maintenance also made in two periods[29]. The first maintenance was conducted between 15/03/2010 and 15/05/2010. During this period, the Wiesner plant operated with pumping San Rafael reservoir and its volume of production decreased 1,5 m^3/s, flow was offset by Tibitoc plant. The service provision since the Chingaza system was normalized from 18/05/2010.

   Chingaza tunnels maintenance was made in two periods under three months in one year, owing to considerations of supply and demand, compensation volume of the reservoir of San Rafael, seasonal climate periods affecting the execution of civil works and contractual considerations associated with the scope of the lining works of the tunnels.

[28] EAAB. Water Supply Direction. Contract No. 1-01-25300-550-2008. Contractor: Consorcio Chingaza SBCC 2008. Start date: 13-11-2008. Completion date: 13-10-2009.

[29] EAAB. Water Supply Direction. Contract No. 1-01-25300-1068-2009. Contractor: Consorcio Chingaza. Start date: 15/02/2010. Completion date: 15/02/2012.

2. Failure of generator Santa Ana Hydroelectric Plant. Due to damage of the generator rotor, the plant out of operation between 23/08/2009 and 05/11/2009, during which failed to generate electricity. The repair was carried out by Electromechanical Services Direction. Once the failure was solved, several measures related with operation of drinking water distribution system of the city were taken to increase the flow available for generation[30].

3. Drought period in the Chingaza system during the month of December 2009. Due to the time of drought that occurred in December 2009 there was a water flow reduction from the Chuza reservoir to the Wiesner plant. For this reason, from 28/12/2009 the opening percentage of pipeline 60" and 72" increased in Tibitoc plant, in order to increase the flow in 1 m^3/s and decrease in this proportion the flow from the Wiesner plant, which is leading the city through the Suba control structure. The flow available for generation was affected in the same proportion.

4. Rehabilitation of pipeline Santa Ana – Usaquén, by Network Matrix Aqueduct Direction. The work was conducted between 26/03/2010 and 29/08/2010, period in which the pipeline and Santa Ana tank were out of operation. This operational scenario decreased the generation flow due to restrictions on the use of infrastructure with respect to normal operating conditions. The operation was normalized from 31/08/2010.

Other events that reduced the generation were intermittent faults occurring on power circuits operated by CODENSA. These unforeseen events left 76,2 hours in which there was no energy generation for the national interconnected grid.

For all the above, for the fifth accreditation year of the project, electric power generation at Santa Ana Hydroelectric Plant was reduced by 34% compared to the estimated annual generation in the Project Design Document (PDD)[31].

B.2. Revision of the monitoring plan

>>

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[30] The flow goes to the Santa Ana tank can be increased if with this flow provide service to the intermediate zone of the city, through the control structures Santa Fe north and south. This adjustment operation in the water system helped to increase the flow available for generation.

[31] The electric power actually generated and delivered to the national interconnected grid during the period August 2008 - July 2009 accounted for 91.5% of the electric power estimated for the same period in the "Planning of Power Generation," prepared by the Network. Matrix Aqueduct Direction.

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B.3. Request for deviation applied to this monitoring period

>>

Not applicable.

B.4. Notification or request of approval of changes

>>

Not applicable.

SECTION C. Description of the monitoring system

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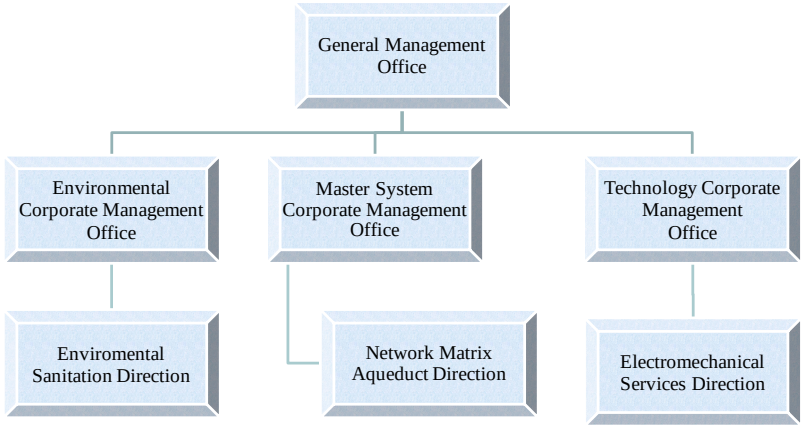
Operational and administrative structure

Figure 6 shows the part of EAAB´s organizational structure[32] responsible of the administration, operation, maintenance and monitoring CDM project Santa Ana Hydroelectric Plant, during the fifth year of accreditation period.

FIGURE 6
OPERATIONAL AND ADMINISTRATIVE STRUCTURE
SANTA ANA HYDROELECTRIC PLANT



[32] EAAB: Agreement 11 of 2007. By means of which is modified the Organizational Structure of *Empresa de Acueducto y Alcantarillado de Bogota - ESP* and identify the functions of its dependencies.

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 exercise 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 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 2009 – 2010, there were several activities related to implementation of quality management system:

A. Planning process.

In January of 2009 and 2010 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 2010, it included an adjustment to the electric power generation planning for the year.

B. Business operations processes.

The processes, procedures and instructions that are listed in Table 3 were updated to include the electric power generation activities and comply with standard numerals NTC ISO 9001:2008.

TABLE 3
BUSINESS OPERATIONS PROCESSES

Macroprocess	Process	Procedures	Instructions	Format
Management Strategy	Planning and Evaluation Strategy	**EE0112P-01** Expansion planning, optimization, rehabilitation and mitigation of the vulnerabilities identified in the network matrix aqueduct.		
		EE0113P-01 Operation planning		
		EE0114P-01 Maintenance planning.		
Aqueduct Service	Distribution and Control Main Pipelines	**MA0401P-01** Coordination of operation.	**MA0401I02-01** Routine Santa Ana station.	**MA0401F08-01** Santa Ana Hydroelectric Plant generation.
		MA0402P-01 Operational hydraulic simulation.		
		MA0403P-01 Coordination of scheduled closures.		
		MA0404P-01 Coordination of unforeseen closures.		
		MA0405P-01 Implementation of closures, drains and restored.		
		MA0406P-01 Contingencies care.		
		MA0407P-01 Electric power generation.	**MA0407I01-01** Start-up and operation of small hydroelectric plant.	**MA0407F04-01** Data compare.
			MA0407I02-01 Measurement and data analyses.	
			MA0407I03-01 Load rejection.	
			MA0407I04-01 Reconciliation of results.	
	Maintenance Main Pipelines	**MA0501P-01** Preventive maintenance electromechanical of system matrix structures.		
		MA0502P-01 Accommodations locative.		
		MA0503P-01 Tanks washing.		
		MA0504P-01 Preventive maintenance of Santa Ana Hydroelectric Plant.		
		MA0505P-01 Review pressure control stations.		
		MA0507P-01 Repairing matrix system cameras and accessories.		
		MA0508P-01 Repairing matrix system structures.		

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
Management Strategy	Planning and documentation management system	**EE0302P** Process documentation.

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

Macroprocess	Process
Information and Knowledge Management.	Document management

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

Macroprocess	Process	Procedure
Aqueduct Service	Distribution and Control Main Pipelines	**MA0417P-01** Control of electric power generation measurement equipments.

D. Continuos improvement process.

1) Customers 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
Evaluation, Improvement and Prevention	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
Evaluation, Improvement and Prevention	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
Evaluation, Improvement and Prevention	Management system evaluation	**CE0102P-01** Management system measurement.

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

Macroprocess	Process	Procedure
Evaluation, Improvement and Prevention	Management system evaluation	**CE0101-02** Internal audit.

In November 2009, 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

Rol	Measurement		Registration		Verification		Report		Calibration and Maintenance Equipment	
	Internal	External	Internal	External	Internal	External	Internal	External	Internal	External
Authority	Director Electromechanical Services Office Director	EMGESA	Director Electromechanical Services Office Director	EMGESA	Director Electromechanical Services Office Director	XM EMGESA CODENSA	Director Electromechanical Services Office Director	EMGESA	Director Electromechanical Services Office Director	EMGESA CODENSA
Responsibility	Energy Negociator	CAM	Energy Negociator	CAM	Energy Negociator	CAM CODENSA EMGESA	Energy Negociator	CAM	Energy Negociator	CAM

Data collection

The instructive 8SA2015054001 "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 the electric power generated and delivered to the grid is performed each 24 hours:

- EMGESA, trough CAM, performs interrogation of the commercial frontier meter, located in the Usaquén electrical substation, owned by CODENSA, accordance with the CREG Resolution 006 of 2003.
- EAAB, trough Electric Power Negociator, performs the automatic and electronic interrogation of the meter located in the Usaquén electrical substation, owned by EAAB, trough the software JEAMREAD.

- ✓ **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 3SA2015054004 "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 performs in the format 3SA2015054004 "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 of 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 instructions 8SA2015054002 "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 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 (15^{th} 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.

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors	
(Copy this table for each data and parameter. To report multiple values, a table may be used)	
Data / Parameter:	Emission factor of the national interconnected grid of Colombia.
Data unit:	kg CO_2e per 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 used:	Resolution 181421 of 2005 issued by Ministry of Mines and Energy of Colombia.
Value(s) :	0.4392
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline: 0.4392 kg CO_2e per KWh. Project: 0.4392 kg CO_2e per KWh.
Additional comment:	Not applicable.

D.2. Data and parameters monitored	
(Copy this table for each data and parameter. To report multiple values, a table may be used)	
Data / Parameter:	KWh generated and delivered daily to the national interconnected grid of Colombia.
Data unit:	KWh.
Description:	Amount of electricity generated and delivered to the interconnected national grid of Colombia.
Measured /Calculated	Measured.

/Default:	
Source of data:	Daily records of ccommercial frontier meter, located in the Usaquén electrical substation, owned by CODENSA.
Value(s) of monitored parameter:	See worksheet: *CO_2e Emissions Reduction Santa Ana Hydroelectric Plant (1-08-2009 to 31-07-2010). Xls*
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline: KWh generated and delivered to the national interconnected grid of Colombia. Project: KWh generated and delivered to the national interconnected grid of Colombia.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Electric power meters of commercial frontier: • Localization: Usaquén electrical substation, owned by CODENSA. • Manufacturer: SIEMENS. • Type: MAXSYS 2510. • Model: 99-SWB. • Accuracy class: 0.2S. • Serial number: Main meter No. 30031; supporting meter No. 30029. • Calibration certificates: CAM-IMNC1003-0003307 issued on 15/03/2010; CAM-IM0807-003322 issued on 27/06/2008. • Tests performed at the Meters Laboratory of CAM, as per the Colombian Technical Standard NTC 4856. • Tests performed: accuracy; constant verification; operation without charge. • Test results: Conform meter No. 30029. Not conform in accuracy test of active potency meter No. 30031. Electric power meters for direct measurement of EAAB: • Localization: Usaquén electrical substation, owned by EAAB. • Manufacturer: AMETEK. • Serial number: main meter No. 14600821; supporting meter No. 14600822. Type JEMStar, Model JS-09R6010-31, Accuracy Class 0.2S. • Calibration certificates: CAM-IM1003-001400 issued on 16/03/2010; 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: Accuracy tests, Constant verification test, and operation without charge. • Test results: Conform.
Measuring/ Reading/ Recording frequency:	The electric power generation is measured daily in the commercial frontier meter. That electric power generation data are registered and available for consultation on the website of XM (http://sv04.xm.com.co/neonweb/SeleNeon.asp).
Calculation method (if applicable):	Not applicable.
QA/QC procedures applied:	Procedure: MA0407P-01 "Electric power generation" Instructive: MA0407I01-01 "Start-up and operation of small hydroelectric plant". Instructive: MA0407I02-01 "Measurement and data analyses". Instructive: MA0407I03-01 "Load rejection".

	Instructive: MA0407I04-01 “Reconciliation of results”. Instructive: MA0417P-01 “Control of electric power generation measurement equipments”. Instructive: MA0401I02-01 “Routine Santa Ana station”.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

>>

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.

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 108/2009 – 31/07/2010.

TABLE 5
ELECTRIC POWER DELIVERED TO THE NATIONAL INTERCONNECTED GRID AND ESTIMATION OF CO_2E EMISSIONS REDUCED
AUGUST 1, 2009 – JULY 31, 2010

YEAR	MONTH	ELECTRIC POWER (MW/h)	EMISIONS REDUCED (Ton CO_2e)
2009	AUG	556	244
	SEP	0	0
	OCT	0	0
	NOV	3.654	1.605
	DEC	2.745	1.206
2010	JAN	2.835	1.245
	FEB	3.258	1.431
	MAR	3.075	1.351
	APR	2.361	1.037
	MAY	3.074	1.350
	JUN	4.681	2.056
	JUL	4.684	2.057
Total		30.924	13.582

See worksheet: *CO_2e Emissions Reduction Santa Ana Hydroelectric Plant (1-08-2009 to 31-07-2010). xls*

E.2. Project emissions calculation

>>

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. Leakage calculation

>>

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. Emission reductions calculation / table

>>

Total baseline emissions: 13.582 Ton CO_2e.
Total project emissions: 0 Ton CO_2e.
Total leakage: 0 Ton CO_2e.
Total emission reductions: 13.582 Ton CO_2e.

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

>>

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	20.642	13.582

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

>>

Not applicable.

- - - - -

History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		