

**MONITORING REPORT FORM (CDM-MR)**
Version 01 - in effect as of: DD/MM/YYYY**CONTENTS**

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**MONITORING REPORT****VERSION 4****31/05/2010****SANTA ANA HYDROELECTRIC PLANT****0275****FOURTH PERIOD****01/08/2008 – 31/07/2009****SECTION A. General description of the project activity****A.1. Brief description of the project activity: >>**

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The Santa Ana Hydroelectric Plant is a run-of-river type mini hydro plant, located on the outskirts of Bogotá, Colombia.

The city of Bogotá relies on three principal sources of drinking water: Tibitoc, La Regadera, and Chingaza, the most recent source. These supplies are interconnected into an optimized water supply and distribution network, operated by Empresa de Acueducto y Alcantarillado de Bogotá (EAAB). Vulnerability analyses by Acueducto (considering both probable network Operation & Maintenance scenarios, as well as potential collapses of water conducting infrastructure) of the water supply system of Bogotá, concluded that a reservoir (San Rafael) needed to be built under the Chingaza system in order to ensure adequate supply of drinking water to the city. In order to comply with reliability requirements, an additional water-conducting tunnel with a length of 2.5 km was constructed in order to appropriately deliver the drinking water into the distribution system to the city. The Santa Ana Hydroelectric Plant is installing at the base of the tunnel a power house with hydroelectric energy conversion equipment, that will turbine the water passing from the Wiesner water treatment plant into the distribution/storage system of the city, producing clean electric power to be placed into the Colombia national interconnected grid, following local existing electric power market regulations and required environmental and operational permits. A key objective of the project is to reduce greenhouse gas emissions from the National Interconnected Grid of Colombia.

The Santa Ana Hydroelectric Plant was designed for a water flow of 13.5 m³/s, has a design capacity of 13.43 MW and uses a net head of 105.9 m, which could generate 90 GWh/year, using a horizontal shaft Francis turbine installed in the powerhouse. 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 Santa Ana Hydroelectric Plant and today is estimated at 30 GWh/year and 48 GWh /year.

It began operations in first semester of 2005 and it has been operating of continued manner. During fourth accreditation period (2008-2009) it generated and delivered 33.5 GWh/year to the National Interconnected Grid of Colombia reducing of this way the emission of 14,725 Ton CO₂e 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.

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: Francis turbine horizontal axis; net design head 105.9 meters¹; design flow² 13.5 m³/s; installed capacity 13.43 MW; nominal capacity 12 MW; 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 the EAAB and the operator of the local grid, CODENSA (*Comercializador y Distribuidor de Energía S.A.*)³, in compliance with the provisions made by resolutions 025 of 1995 and 070 of 1998 of the Energy and Gas Regulatory Commission (CREG)⁴.

The administration, operation and maintenance of grid assets, according to the contract signed between the EAAB and CODENSA⁵, 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 Usaqué 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, 1998 and 006 of 2003 and the Colombian Technical Standard NTC - ISO/IEC 17025. The meters have calibration certificate No. CAM-IM0806-000778 (June 26, 2008) and No. CAM-IM0807-003322 (June 27, 2008) respectively.

¹ 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.

² The efficient operation flows are between 5.2 m³/s and 13.5 m³/s.

³ EAAB: Contract No. 9-99-25400-566-2004. Duration: 25 years.

⁴ The Electric power and Gas Regulatory Commission is the Colombian authority that regulates the sector of Electric power and Gas.

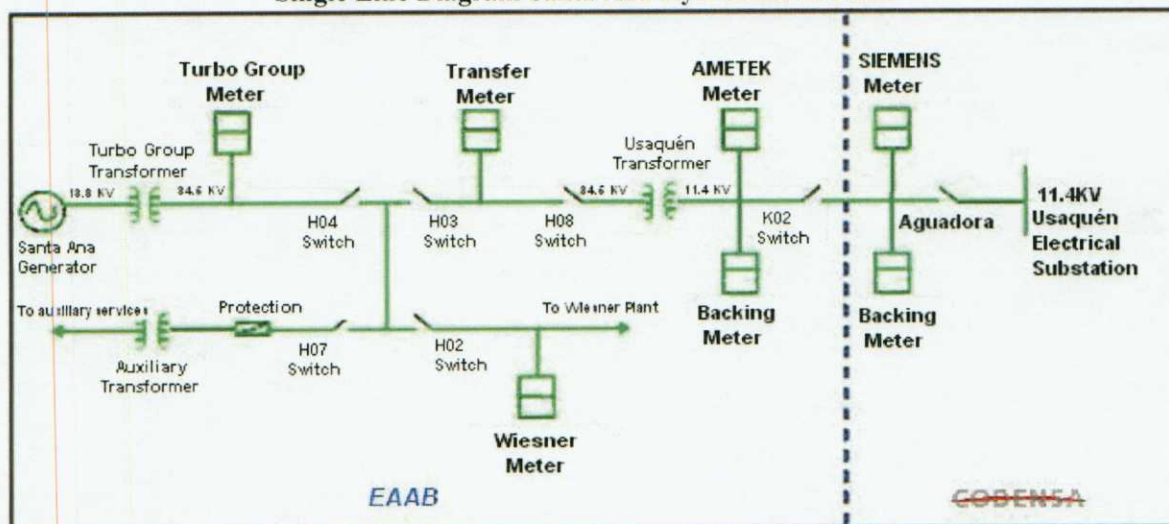
⁵ EAAB: Contract No. 1-99-26300-742-2006. Duration: 1 year. Contract No. 1-99-26300-941-2007. Duration: 1 year.

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

AMETEK meters do not have the formality of registration with the ASIC but they are under full responsibility of the EAAB and have calibration certificates CAM-IM0806-003273 (June 26, 2008) and CAM-IM0806-003274 (June 26, 2008), respectively.

The Single Line Diagram of Santa Ana Hydroelectric Plant (see Figure 6) shows the main line driving the 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 Plant⁶.

Figure 6
Single Line Diagram Santa Ana Hydroelectric Plant



The electric power generated by the Santa Ana Hydroelectric Plant is commercialized by EMGESA⁷ (*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 the EAAB⁸.

⁶ 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".

⁷ Electric Power Generating Company.

⁸ EAAB: Contract No. 1-99-26300-671-2005. Duration: 3 years and 7 months.



As smaller plant began commercial operations on June 10, 2005,⁹ after the official registration of the commercial frontier in the ASIC, with an effective capacity of 8 MW under the following characteristics¹⁰:

| 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)

The registration of the electric power generation makes daily EMGESA, through CAM¹¹ (*Compañía Americana de Multiservicios*), with information obtained through the interrogation, automatic and electronic, of the commercial frontier meter¹².

The data is recorded by CAM in the ASIC (Experts Market - XM)¹³ and communicates to both EAAB as CODENSA. This information is analyzed independently by EMGESA, CODENSA and the 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 XM¹⁴.

CREG resolutions 006 and 015 of 2009 regularized handling confidential 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.

⁹ The period from June 10 up to July 31, 2005, corresponds to the period of testing and adjustments.

¹⁰ Communication No. 010916-1 from ISA to EMGESA, dated June 9, 2005.

¹¹ Multi Services American Company.

¹² 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.

¹³ 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.

¹⁴ NEON database is operated and managed by XM, there are stored all transactions of the Wholesale Power Market of Colombia.



"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 CO₂e/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 Colombia's national interconnected grid defined by the Ministry of Mines and Energy of Colombia by resolution 181421 of 2005.

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.

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| A.6. Registration date of the project activity: |
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Registration date: 11/05/2006.

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| 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: 1-08-2005.

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| A.8. Name of responsible person(s)/entity(ies): |
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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 the city of Bogotá, also supplies some surrounding municipalities: in the north, Gachancipá, Tocancipá, Sopo, Cajicá and Chia; in the east, the town of La Calera; in the western, municipalities as Funza, Madrid and Mosquera and in the south the town of Soacha.

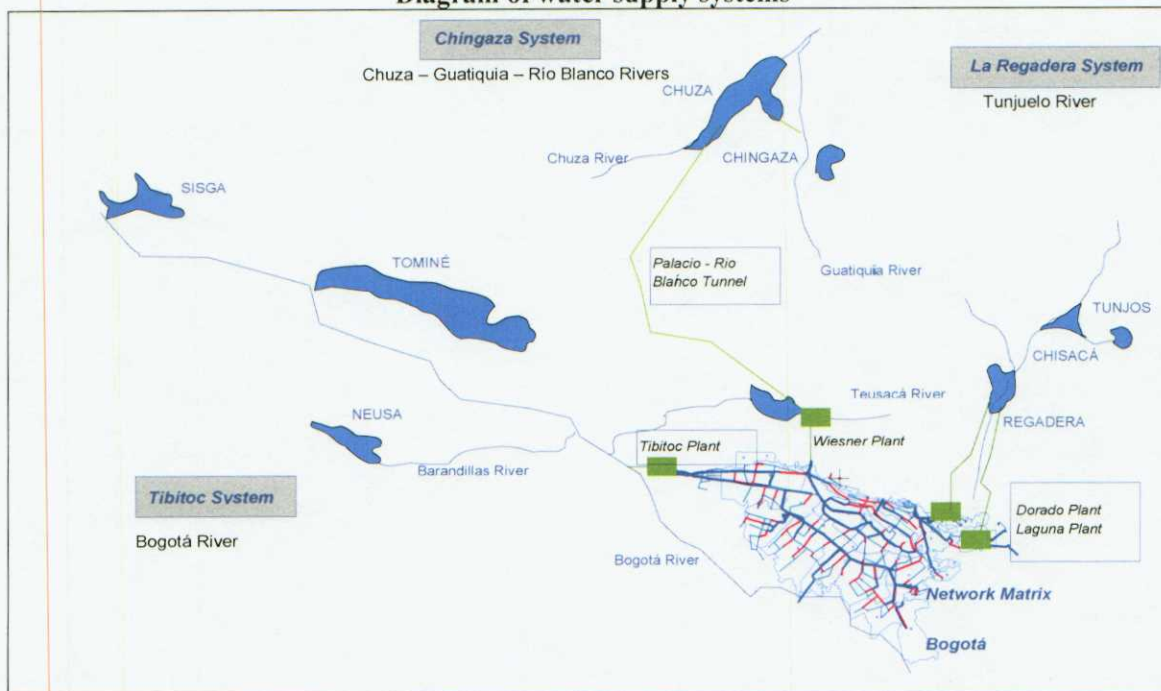
The population served is close to 8 million people, representing nearly 1,500,000 users and require an average daily flow of 15.15 m³/s (period August 2008 - July 2009).

The system has an installed capacity of 26.5 m³/s to produce potable water. This means that the city of Bogotá and surrounding municipalities require 57% of installed capacity. The total installed capacity can only be used by building elements and structures needed in the transmission of raw and treated water to enable their distribution.

The three main systems that supply water to the city of Bogotá and surrounding municipalities are:

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

Figure 1
Diagram of water supply systems



The east supply system is located northeast of the city at the top of the east mountain range. It comprises the Chuza reservoir, some pick up wells (Río Blanco system) and the San Rafael reservoir, which receives water from the Chuza reservoir through an overflow structure located before entering the treatment plant and a minimum input from high Teusacá River. The Chuza water reservoir, which mainly regulates the upstream flow of Guatiquia and Chuza rivers, is conducted at the treatment plant through a tunnel system which initiates conduction of pressurized water 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 is called Francisco Wiesner, whose wealth of production 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 reservoir chamber that allows the regulation of flow Teusacá river. The water collected by gravity from Bogota River and by pumping from Teusacá River, is treated at the Tibitoc plant, whose wealth of production supplies approximately 28% of total demand.

The supply system in the south is formed by a group of dams that regulate the flow of the river's upper basin Tunjuelo. Treatment plants associated with this system are: El Dorado, Vitelma and La Laguna. The last two are used as a contingency endorsement. The production rate of this system provides about 2% of total demand¹⁵.

¹⁵ The Yomasa treatment plant is also considered as part of the southern supply that captures water from a creek that bears its name and has a treatment capacity of 0.025 m³.



Table 1
Storage Capacity and Treatment of the Water Supply Systems

| Supply System | Reservoirs (millions of m ³) | | Treatment Plants (m ³ /s) | |
|---------------------|---|-----|---|------|
| Tibitoc (north) | Tominé | 690 | Tibitoc | 10.5 |
| | Sisga | 102 | | |
| | Neusa | 102 | | |
| | Aposentos | 0.8 | | |
| Chingaza | Chuza | 257 | Francisco Wiesner | 14 |
| | San Rafael | 75 | | |
| La Regadera (south) | Chisacá | 6.7 | El Dorado | 1.6 |
| | La Regadera | 3.3 | La Laguna | 0.45 |
| | Los Tunjos | 2.4 | Vitelma | 0.4 |

Description of the project

The treated water flow in the Chingaza System is conducted through a tunnel known as alternate Usaquén. 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 tanks¹⁶, located in north Bogotá, and to others storage tanks located in center, south east, south west and south of the city, through Rosales tunnel.

In order to take advantage of the difference in available height between the Wiesner plant, located at 2,825 meters above sea level, and Santa Ana tank, located at 2,709 meters above sea level, 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 Plant¹⁷.

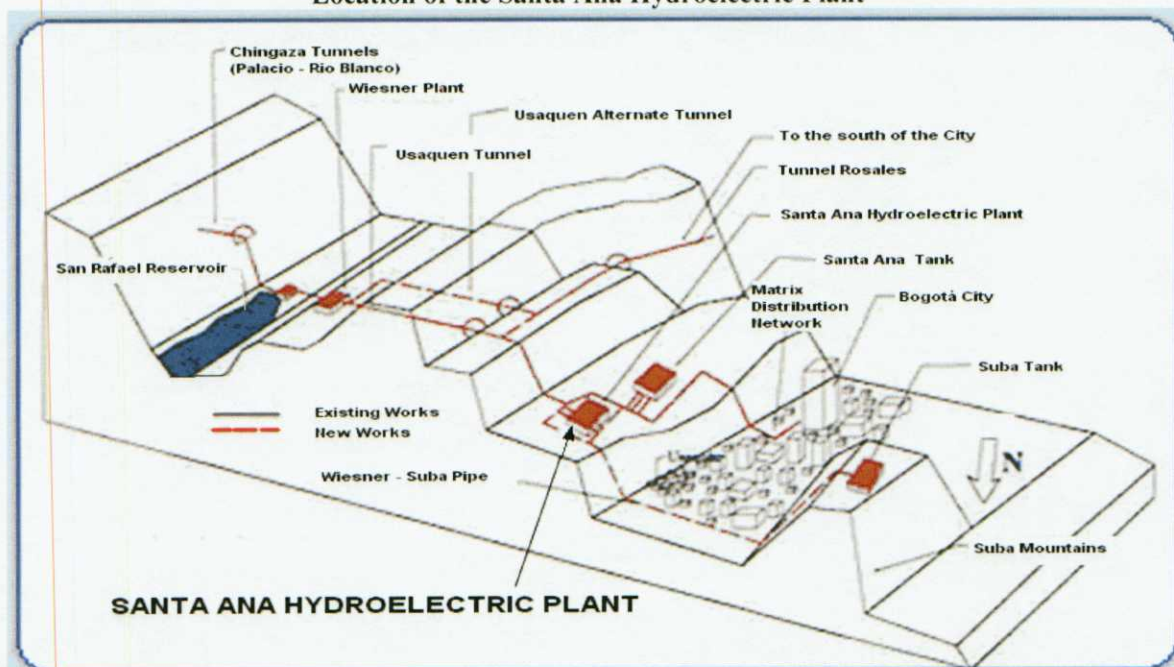
The feeding flow for the Suba and Santa Ana control structures¹⁸, in normal operation is approximately 70% of treated flow at the Wiesner Plant, which corresponds to 55% of the city demand, and provides the aqueduct service to the northern, north-east and west of Bogotá.

¹⁶ The storage capacity of Santa Ana Tank is 30,000 m³ and Suba Tank is 90,000 m³

¹⁷ The turbine is located at 2,704 meters above sea level. That implies a useful gross height of approximately 120 meters between the Wiesner plant and the turbine.

¹⁸ 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.

Figure 2
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 m³/s water flow, considering the Chingaza System - Wiesner Plant expansion project to treat an approximately 21 m³/s water flow¹⁹.

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 nineties²⁰, which was of 17.6 m³/s in 1996 to about 15 m³/s in recent years.

The reduction in city water demand, due to EAAB's efficiency measures, 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 the EAAB to ensure a reliable supply of water required to meet the demand of the city, a 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

¹⁹ 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.

²⁰ EAAB: **Expansion Plan of Water Supply System of the Bogotá 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.



Tunnels Maintenance and Coating Program²¹, seeks to mitigate as much as possible their risk of detachment, coating the tunnels in conventional concrete²².

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 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 Plant²³, 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/year²⁴.

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 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).

²¹ 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

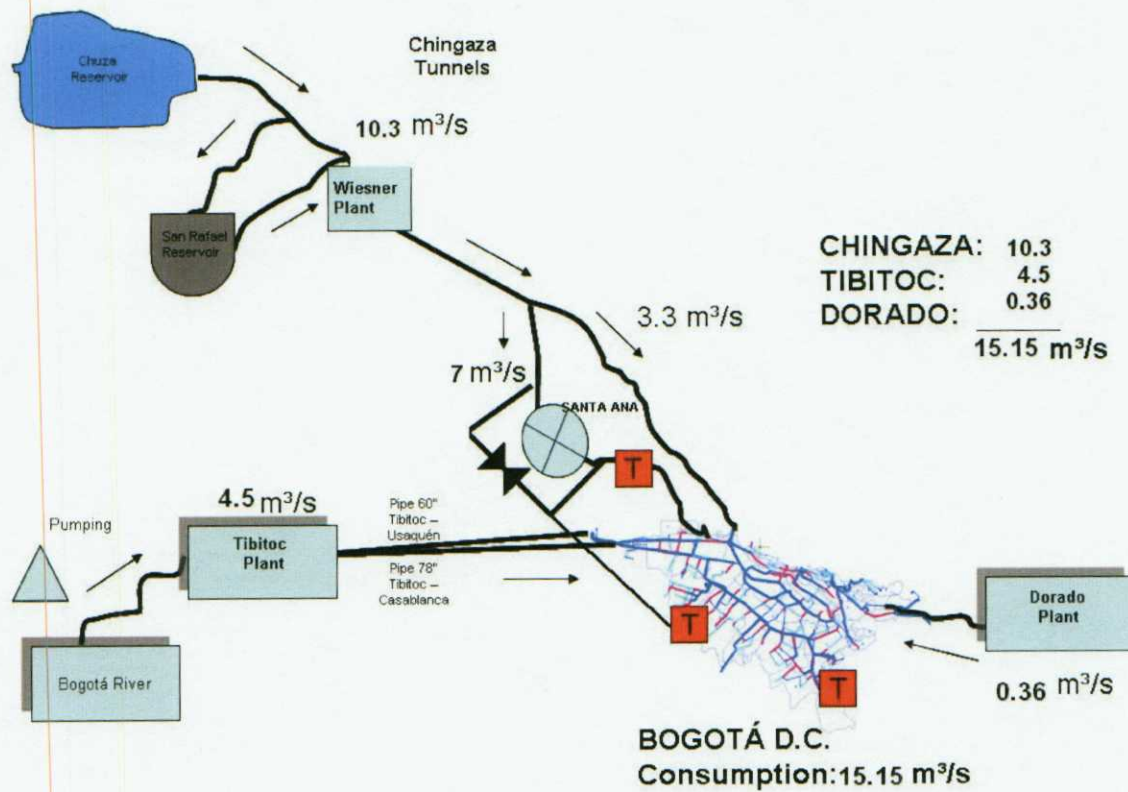
²² Ibid. Report No. 3. Rehabilitation Program, Vulnerability Supply System and Service Life of Assets.

²³ The Santa Ana Hydroelectric Plant could generate using flows $> 3.7 \text{ m}^3/\text{s}$ and $< 5.2 \text{ m}^3/\text{s}$ but is a special operation in which it is required to control vibrations in the turbo group to approach the cavitation region.

²⁴ 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 $3.5 \text{ m}^3/\text{s}$ and in normal operation in $8.6 \text{ m}^3/\text{s}$.

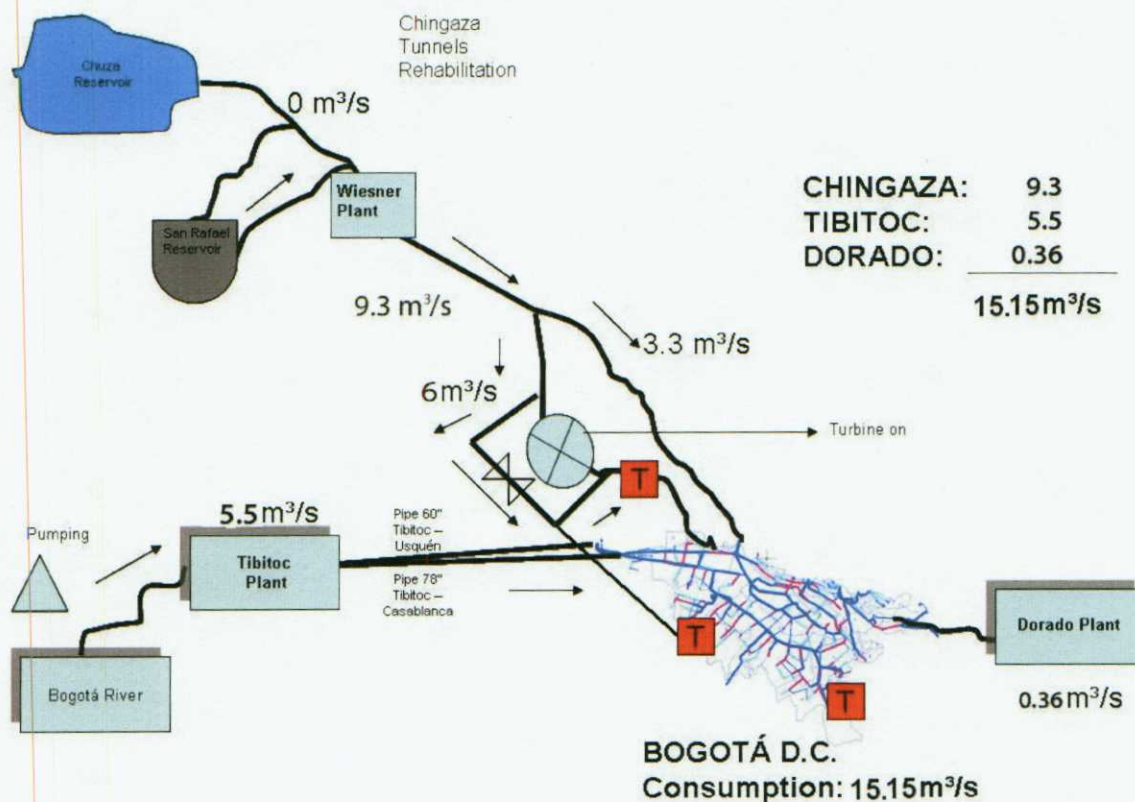
By the previous, the projection of electric power generation at Santa Ana Hydroelectric Plant is being reviewed and are currently estimated that this could be between 30 GWh / year and 48 GWh / year²⁵.

Figure 3
Conditions Normal Operation Water Supply Systems



²⁵ EAAB: Planning Electric power Generation. Period August 2008 - December 2012. Document prepared by the Network Matrix Aqueduct Office. 2008.

Figure 4
Conditions Operation Water Supply Systems
Maintenance and Coating Chingaza Tunnels (Time: 70 Days)



Actual operation of the project

The Santa Ana Hydroelectric Plant began operations on June 10, 2005 but the accreditation period start on August 1, 2005.

For the period from 1/08/2008 to 31/07/2009, the average demand for potable water monthly stood at around 15.15 m³/s, which was produced by flow supply systems as follows:

1. Chingaza System: 9.5 m³/s.
2. Tibitoc System: 5.29 m³/s.
3. La Regadera System: 0.36 m³/s.



As part of controlling the generation of electric power in the Santa Ana Hydroelectric Plant, the Network Matrix Aqueduct Direction monitors hydraulic parameters such as pressure and entrance flow the *Santa Ana system*²⁶ (flow is measured over the finish line to the turbine) and unexpected downtime due to power failure at the *Santa Ana system*.

Table 2 presents the average monthly entrance flow of Santa Ana system, during the period 1/08/2008 – 31/07/2009.

Table 2
Monthly Average Flow of the Santa Ana System

| YEAR | MONTH | REGISTERED FLOW (m ³ /s) |
|------|-------|-------------------------------------|
| 2008 | AUG | 4,99 |
| | SEP | 5,16 |
| | OCT | 4,83 |
| | NOV | 4,96 |
| | DEC | 4,92 |
| 2009 | JAN | 4,71 |
| | FEB | 6,21 |
| | MAR | 6,74 |
| | APR | 6,81 |
| | MAY | 7,04 |
| | JUN | 6,75 |
| | JUL | 6,31 |

Source: Control Center. Network Matrix Aqueduct Direction.

During the fourth year of verification, the average monthly entrance flow turbine was affected by aqueduct system operational events, which reflects the maintenance dynamic of pipelines sections, structures and mechanical elements located in the distribution network and the adduction lines.

For the period between August 2008 and July 2009, the Network Matrix Aqueduct and Water Supply Directions implemented the following activities, which affected the operation of the Santa Ana Hydroelectric Plant and decreased the entrance flow to the turbine:

- 1) Inspection and evaluation of Santa Ana – Usaquén pipeline by the Network Matrix Aqueduct Direction²⁷. This pipeline was kept out of operation since 06/05/2008 to 08/03/2009. This condition created an operation scheme in which Santa Ana tank and Santa Ana-Usaquén pipeline went out of service and was unable to regulate the service at nearby areas. Under this

²⁶ 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 pipelines are average flow available for generation while the third pipeline doesn't. 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 northeast 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.

²⁷ EAAB - ESP. Network Matrix Aqueduct Direction. Contract No. 2-01-25400-849-2008. Contractor: Nema Ingeniería Ltda. Start date: 13-01-2009. Completion date: 28-03-2009.



new scheme of operation is not possible the water supply through Santa Ana tank, decreasing the entrance flow the Santa Ana system about $2.1 \text{ m}^3/\text{s}$.

- 2) Restoration and structural reinforcement of the Santa Ana tank, by Network Matrix Aqueduct Direction²⁸. The tasks were completed on 31/05/2008. However, the tank was kept out of operation at all 2008 due to the works in Santa Ana-Usaquén pipeline, described in the preceding paragraph. The tank works were completed but not available pipeline²⁹.
- 3) Chingaza tunnels maintenance, by the Water Supply Direction³⁰. These jobs were implemented in two periods³¹. The first maintenance was conducted between 13/11/2008 and 19/01/2009, period in which the Wiesner plant operated pumping San Rafael reservoir and during this period left the city without $1.2 \text{ m}^3/\text{s}$, compensated by Tibitoc plant. The service delivery from the Chingaza system began on 22/01/2009 but the available flow for generation is not normalized by the constraint that generates the Santa Ana tank maintenance and the Santa Ana - Usaquén pipeline out of service (see previous paragraph).

The second maintenance started on 13/07/2009 and ended 17/09/2009, and like the previous maintenance, Wiesner plant operated pumping San Rafael reservoir. During this period left the city without $1 \text{ m}^3/\text{s}$, compensated by Tibitoc plant.

Chingaza tunnels maintenance was made in two periods under three months for 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.

- 4) Rehabilitation works of the water adduction channel, as well as columns and walls of Wiesner Plant tank³².

Other events that reduced the generation were intermittent faults occurring on power circuits operated by CODENSA. These unforeseen events left 508 hours in which there was no energy for the national interconnected grid.

For all the above, for the fourth accreditation year of the project, electric power generation at Santa Ana Hydroelectric Plant was reduced by 29% compared to the estimated annual generation in the Project Design Document (PDD)³³.

²⁸ EAAB - ESP. Network Matrix Aqueduct Direction. Contract No. 1-01-25400-570-2007. Contractor: Aplicaciones Técnicas y Servicios ATS LTDA. Start date: 21-01-2008. Completion date: 21-08-2008.

²⁹ If the tank Santa Ana is in maintenance, the Santa Ana Hydroelectric Plant can generate because the flow is distributed to Suba tank is about $5 \text{ m}^3/\text{s}$, flow of plant operation.

³⁰ From a total of 32.4 km of tunnels had been coated, to October 2009, 20.5 km.

³¹ EAAB - ESP. 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.

³² EAAB: Water Supply Direction. Contract No. 1-01-25300-667-2007. Contractor: Consorcio Obras Civiles 2007. Start date: 22-02-2008. Completion date: 20-02-2009.

³³ 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.

**B.2. Revision of the monitoring plan**

>>

The monitoring report version was reviewed on 31/05/2010 by:

Last name: Jiménez Aldana
First name: Mauricio
Office: Network Matrix Aqueduct Director – EAAB.
Email: mjimnez@acueducto.com.co
Telephone: (571) 3447136
Fax: (571) 344 7000 Ext.7136 Option 1
Address: Avenida Calle 24 No. 37 – 15

The monitoring report was approved on 31/05/2010 by:

Last name: Triana Luna
First name: Humberto
Office: Environmental Corporate Manager
Email: htriana@acueducto.com.co
Telephone: (571) 3447058
Fax: (571) 344 7000 Ext.7058 Option 1
Address: Avenida Calle 24 No. 37 – 15

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

>>

Please indicate any deviation applied to this monitoring period. Include the reference number, if any deviation applied.

B.4. Notification or request of approval of changes

>>

Not applicable.

SECTION C. Description of the monitoring system

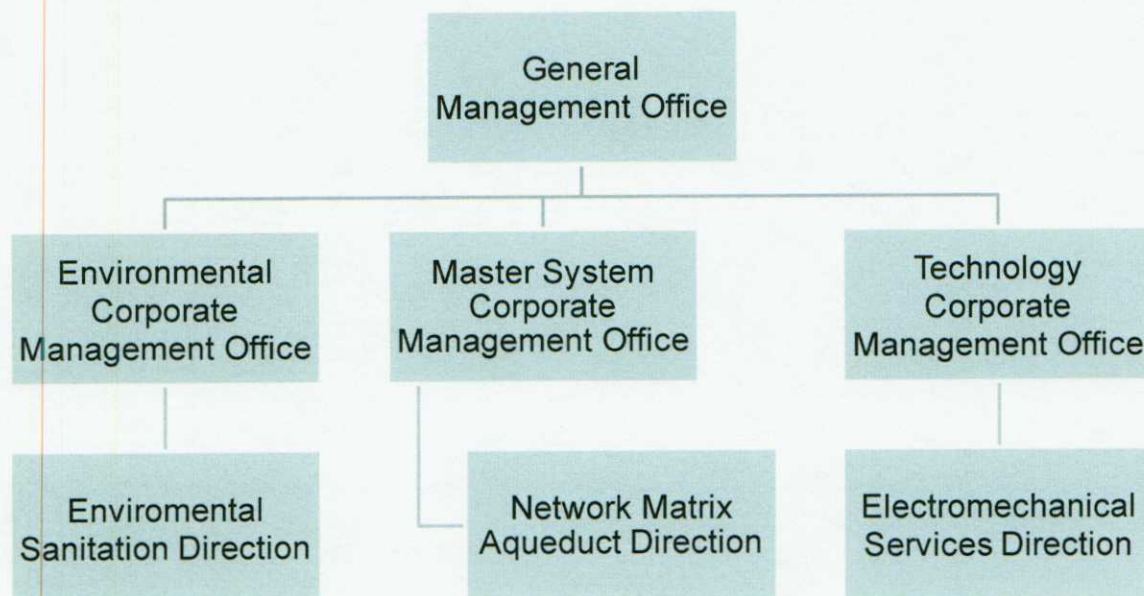
>>

Operational and administrative structure

Figure 5 shows the part of the organizational structure of EAAB³⁴ who was responsible for the administration, operation, maintenance and monitoring CDM project Santa Ana Hydroelectric Plant, during the fourth period.

³⁴ 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.

Figure 5
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 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 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, which is responsible for preparing the monitoring report with the support of the Electromechanical Services and Network Matrix Aqueduct Directions.



Procedures for quality assurance

In committee on quality of Network Matrix Aqueduct Direction (management review 08/11/07)³⁵ it was decided to modify the *quality management system for driving and drinking water distribution networks* and arrays to broaden its scope including power generation activities.

To comply with the above, the following activities have been conducted:

A. Planning processes:

- 1) **Strategic planning:** strategic plan for the macro-process of drinking water conduction and distribution in matrix networks was amended to include all aspects of electric power generation. By quality committee (management review 08/11/07) there was approved: mission, vision, quality policy, quality objectives and customers - suppliers.
- 2) **Work plans:** the action plan for each year 2008 and 2009 was done in both cases in January in order to plan the activities from Network Matrix Aqueduct Direction. That document included the aspects related to power generation. Also, was held the electric power generation planning for the period 2008 to 2012.
- 3) **Planning of management system:** the quality manual and plan for drinking water conduction and distribution macro-process in matrix networks were modified to include all aspects of electric power generation. These documents were in adopted in quality committee (management review 26/06/08)³⁶.

B. Process of business operations

The following processes, procedures and instructions were modified to include the activities of electric power generation and thus to comply with numerals of the standard NTC ISO 9001:2008:

Process: Investment Planning.

Process: Operation and Maintenance Planning.

Process: OSA201505 "System Operation".

Process: 0AF101005 "Preventive Maintenance of Matrix System Structures".

Process: 0AF101015 "Corrective maintenance".

Procedure: 1SA20051005 "Operation Planning".

Procedure: 1SA20051010 "Maintenance Planning".

Procedure: 1SA20150505 "Coordination of the Operation".

Procedure: 1AF10101510 "Repairing Matrix System Structures".

Procedure: 1SA20150540 "Power Generation".

Procedure: 1AF10100525 "Preventive Maintenance of Santa Ana Hydroelectric Plant".

Instructive: 7SA2015050502 "Routine Santa Ana Station".

Instructive: 7SA2015054001 "Start-Up and Operation of Small Hydroelectric Plant".

³⁵ Report of the Meeting of Committee on Quality – Management Review – is in the folder EAAB/2541001/080.139/2007 – Management Review 2007

³⁶ Report of the Meeting of Committee on Quality – Management Review – is in the folder EAAB/2541001/080.139/2007 – Management Review 2008.



Instructive: 8SA2015054001 "Measurement and Data Analysis".

Instructive: 8SA2015054002 "Conciliation of Results".

Instructive: 7SA2015054002 "Load Rejection".

C. Resource management processes

- 1) **Information management:** for the preparation and updating all documents of the quality management system applied the procedure "Process Documentation" 1GD0505.
- 2) **Document management:** each record was filed in accordance with the manual of archive of the company.
- 3) **Financial and administrative management:**

Process: 0SA202005 "Financial and Administrative Management."

Procedure: 1SA20200550 "Power Marketing".

Procedure: 1SA20200555 "Management of Certified Emission Reductions (CER)".

- 4) **Control of measurement equipment:**

Procedure 1AC1015 "Control of Measuring Equipment Power Generation". It includes resumes and measuring equipment calibrations.

D. Continuous improvement process:

- 1) **Customer care and satisfaction:** for this process is carried out satisfaction surveys to the Environmental Corporate Management, who received all the information to monitor the CDM project and to the Electromechanical Services Direction as the area that manages the marketing of the electric power generated by the plant.
- 2) **Non-compliance treatment:** in order to follow up non-compliant of electric power generation in the quality plan was created the format 3SA2015054003 "Power Generation Control".
- 3) **Measurement systems:** during the period being reported it has continued with the calculation of the electric power generation indicator, which allows you to track the power generation, power generation income, issuance of certified emission reductions (CER) and revenues marketing of such certificates. In monthly meetings for monitoring action plans and indicators are analyzed the indicators results.
- 4) **Internal audit:** during the period being reported the internal audit comments has been attended (internal audits carried out in July 2007 and November 2008). The certification audit was programmed for December 2008 in order to expand the scope of the quality management system for conduction and distribution of drinking water in matrix networks and to include the electric power generation activities.
- 5) **Opportunities for improvement:** for the period 1/08/2008 – 31/07/2009, were documented six opportunities for improvement related to the incorporation of electric power generation: 1. Consider power generation planning; 2. Consider in the characterization of the process OSA201505 "System operation" the diversion of energy generated on the planned; 3. Make clear that in formulating the generation indicator, the planning is considered; 4. Detail the risks



in the characterization because is mentioned in general form; 5. Include in the characterization: the CREG resolution 006 of 2003, the software JEMREAD and EMGESA as supplier and customer; 6. Consider the statistics of "nonconforming product" for tracking the activity of generation.

In December 2008, ICONTEC conducted the certification audit in order to broaden the scope of quality management system for driving and drinking water distribution networks and matrices include electric power generation activities. This certification was given in January 2009 and its scope, under ISO 9001:2008 is: *"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"*.

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. 3.

Table 3
Authority and Responsibility Roles of Monitoring Plan

| | Measurement | | Registration | | Verification | | Report | | Calibration and Maintenance Equipment | |
|----------------|--|----------|--|----------|--|--------------------|--|----------|--|----------------|
| | Internal | External | Internal | External | Internal | External | Internal | External | Internal | External |
| Authority | Director Electromechanical Services Office | EMGESA | Director Electromechanical Services Office | EMGESA | Director Electromechanical Services Office | XM EMGESA CODENSA | Director Electromechanical Services Office | EMGESA | Director Electromechanical Services Office | EMGESA CODENSA |
| Responsibility | Energy Negotiator | CAM | Energy Negotiator | CAM | Energy Negotiator | CAM CODENSA EMGESA | Energy Negotiator | CAM | Energy Negotiator | 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.

The data collection instructions are as follows:

✓ Measurement

In order to establish the amount of electric power generated and delivered by the Santa Ana Hydroelectric Plant to the grid, in 24 hours:

- EMGESA, through 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, through Electric Power Negociator, performs the automatic and electronic interrogation of the meter located in the Usaquén electrical substation, owned by EAAB, through 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 data generation on the website of XM (Experts Market) – www.xm.com.co
- Sending electric power generation data through email to EAAB. This information is sent every 24 hours.

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

- Checking the historical data generation.
- Recording electric power generation data on electronic format 3SA2015054004 "Data Comparison".

✓ **Verification**

Every 24 hours, EAAB performs the verification of the daily generation measurement 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 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.

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 (15th of every month).

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. After the conciliation process, EMGESA reported the daily generation data on website of XM.

✓ **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 CO₂e of Santa Ana Hydroelectric Plant applying the emission factor of the national interconnected grid, 0.4392 kg CO₂e 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 Colombia national interconnected grid. |
| Data unit: | kg CO ₂ e 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 ₂ e per KWh. Project: 0.4392 kg CO ₂ e 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 Colombia national interconnected grid. |
| Data unit: | KWh |
| Description: | Amount of electricity generated and delivered to the Colombia interconnected national grid. |
| Measured /Calculated /Default: | Measured. |
| Source of data: | Daily records of commercial frontier meter, located in the Usaquén electrical substation, owned by CODENSA. |
| Value(s) of monitored parameter: | See worksheet: <i>CO₂e Emissions Reduction Santa Ana Hydroelectric Plant (1-08-08 to 31-07-09). xls</i> |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline: KWh generated and delivered to the Colombia national interconnected grid. Project: KWh generated and delivered to the Colombia national interconnected grid. |
| Monitoring equipment (type, accuracy class, serial | Electric power meters of commercial frontier: |



| | |
|--|---|
| number, calibration frequency, date of last calibration, validity) | <ul style="list-style-type: none"> • Localization: Usaquén electrical substation, owned by CODENSA. • Manufacturer: SIEMENS. • Serial number: Main Meter, 30031; Supporting Meter, 30029. Type MAXSYS 2510, Model 99-SWB, Accuracy Class 0.2S. • Calibration certificates: CAM- IM0806-000778 issued on June 26, 2008; and CAM-IM0807-003322 issued on June 27, 2008. • 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. <p>Electric power meters for direct measurement of EAAB:</p> <ul style="list-style-type: none"> • 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-IM0806-003273 and CAM-IM0806-003274 issued on June 26, 2008. • 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 (see Annex 1). |
| Calculation method (if applicable): | Not applicable. |
| QA/QC procedures applied: | Procedure: ISA20150540 "Power Generation". Instructive: 8SA2015054001 "Measurement and Data Analysis". Instructive: 8SA2015054002 "Conciliation of Results". |

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 Colombia national interconnected grid (measured in kg CO₂ equ/kWh).

The baseline of Santa Ana Hydroelectric Plant uses the official emission factor of Colombia national interconnected grid defined in the Resolution 181421 of November 2005, issued by Ministry of Mines and Energy of Colombia: 0.4392 kg CO₂e/kWh.



The Table 4 presents the KWh generated and delivered monthly to the Colombia national interconnected grid and the respective CO₂e emissions reduced during the period 108/2008 – 31/07/2009.

Table 4
Electric Power Delivered to the National Interconnected Grid
and Estimation of CO₂e Emissions Reduced
August 1, 2008 – July 31, 2009

| YEAR | MONTH | ELECTRIC POWER (MW/h) | EMISSIONS REDUCED (Ton CO ₂ e) |
|-------|-------|-----------------------------|---|
| 2008 | AUG | 2.465 | 1.083 |
| | SEP | 2.575 | 1.131 |
| | OCT | 1.961 | 861 |
| | NOV | 2.437 | 1.070 |
| | DEC | 2.016 | 886 |
| 2009 | JAN | 1.395 | 613 |
| | FEB | 3.014 | 1.324 |
| | MAR | 3.708 | 1.628 |
| | APR | 3.450 | 1.515 |
| | MAY | 4.130 | 1.814 |
| | JUN | 3.555 | 1.562 |
| | JUL | 2.819 | 1.238 |
| Total | | 33.526 | 14.725 |

See worksheet: *CO₂e Emissions Reduction Santa Ana Hydroelectric Plant (1-08-08 to 31-07-09). 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



>>

This section shall include the formulae used to calculate the emission reductions and the total of the emission reductions achieved during the monitoring period.

Total baseline emissions: 14,725 Ton CO₂e.

Total project emissions: 0 Ton CO₂e.

Total leakage: 0 Ton CO₂e

Total emission reductions: 14,725 Ton CO₂e.

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

>>

This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

| Item | Values applied in ex-ante calculation of the registered CDM-PDD | Actual values reached during the monitoring period |
|--|---|--|
| Emission reductions (tCO ₂ e) | 20,642 | 14,725 |

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 | | |

1/3/2010 11:10:37 AM

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GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|-----------|
| 01/08/2008 | 88,684.00 |
| 02/08/2008 | 98,956.00 |
| 03/08/2008 | 77,456.00 |
| 04/08/2008 | 86,704.00 |
| 05/08/2008 | 88,268.00 |
| 06/08/2008 | 88,800.00 |
| 07/08/2008 | 78,636.00 |
| 08/08/2008 | 87,142.00 |
| 09/08/2008 | 72,924.00 |
| 10/08/2008 | 70,262.00 |
| 11/08/2008 | 81,894.00 |
| 12/08/2008 | 85,028.00 |
| 13/08/2008 | 82,350.00 |
| 14/08/2008 | 85,012.00 |
| 15/08/2008 | 84,974.00 |
| 16/08/2008 | 89,134.00 |
| 17/08/2008 | 68,008.00 |
| 18/08/2008 | 56,354.00 |
| 19/08/2008 | 84,030.00 |
| 20/08/2008 | 86,460.00 |
| 21/08/2008 | 87,546.00 |
| 22/08/2008 | 79,780.00 |
| 23/08/2008 | 53,310.00 |
| 24/08/2008 | 78,640.00 |
| 25/08/2008 | 81,732.00 |
| 26/08/2008 | 84,482.00 |
| 27/08/2008 | 83,648.00 |
| 28/08/2008 | 84,184.00 |
| 29/08/2008 | 48,518.00 |
| 30/08/2008 | 60,758.00 |
| 31/08/2008 | 81,522.00 |

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GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|-----------|
| 01/09/2008 | 84,926.00 |
| 02/09/2008 | 86,148.00 |
| 03/09/2008 | 89,218.00 |
| 04/09/2008 | 86,976.00 |
| 05/09/2008 | 71,864.00 |
| 06/09/2008 | 99,134.00 |
| 07/09/2008 | 82,634.00 |
| 08/09/2008 | 86,684.00 |
| 09/09/2008 | 87,890.00 |
| 10/09/2008 | 87,872.00 |
| 11/09/2008 | 90,768.00 |
| 12/09/2008 | 92,592.00 |
| 13/09/2008 | 99,880.00 |
| 14/09/2008 | 84,366.00 |
| 15/09/2008 | 87,294.00 |
| 16/09/2008 | 86,054.00 |
| 17/09/2008 | 87,310.00 |
| 18/09/2008 | 78,078.00 |
| 19/09/2008 | 72,174.00 |
| 20/09/2008 | 94,826.00 |
| 21/09/2008 | 74,934.00 |
| 22/09/2008 | 82,102.00 |
| 23/09/2008 | 88,602.00 |
| 24/09/2008 | 85,592.00 |
| 25/09/2008 | 76,824.00 |
| 26/09/2008 | 84,768.00 |
| 27/09/2008 | 93,874.00 |
| 28/09/2008 | 78,940.00 |
| 29/09/2008 | 86,050.00 |
| 30/09/2008 | 86,544.00 |

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GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|-----------|
| 01/10/2008 | 84,428.00 |
| 02/10/2008 | 81,688.00 |
| 03/10/2008 | 86,062.00 |
| 04/10/2008 | 93,542.00 |
| 05/10/2008 | 47,600.00 |
| 06/10/2008 | 76,046.00 |
| 07/10/2008 | 75,522.00 |
| 08/10/2008 | 55,914.00 |
| 09/10/2008 | 75,168.00 |
| 10/10/2008 | 54,966.00 |
| 11/10/2008 | 53,088.00 |
| 12/10/2008 | 29,958.00 |
| 13/10/2008 | 11,574.00 |
| 14/10/2008 | 79,548.00 |
| 15/10/2008 | 82,168.00 |
| 16/10/2008 | 80,216.00 |
| 17/10/2008 | 80,954.00 |
| 18/10/2008 | 61,934.00 |
| 19/10/2008 | 76,316.00 |
| 20/10/2008 | 77,238.00 |
| 21/10/2008 | 46,608.00 |
| 22/10/2008 | 0.00 |
| 23/10/2008 | 0.00 |
| 24/10/2008 | 96.00 |
| 25/10/2008 | 36,294.00 |
| 26/10/2008 | 76,706.00 |
| 27/10/2008 | 84,486.00 |
| 28/10/2008 | 86,454.00 |
| 29/10/2008 | 86,734.00 |
| 30/10/2008 | 87,254.00 |
| 31/10/2008 | 92,478.00 |

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GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/11/2008 | 90,928.00 |
| 02/11/2008 | 46,226.00 |
| 03/11/2008 | 34,072.00 |
| 04/11/2008 | 81,580.00 |
| 05/11/2008 | 92,190.00 |
| 06/11/2008 | 87,900.00 |
| 07/11/2008 | 91,988.00 |
| 08/11/2008 | 91,548.00 |
| 09/11/2008 | 84,866.00 |
| 10/11/2008 | 88,732.00 |
| 11/11/2008 | 78,702.00 |
| 12/11/2008 | 81,534.00 |
| 13/11/2008 | 53,968.00 |
| 14/11/2008 | 87,232.00 |
| 15/11/2008 | 88,932.00 |
| 16/11/2008 | 41,712.00 |
| 17/11/2008 | 44,830.00 |
| 18/11/2008 | 86,856.00 |
| 19/11/2008 | 89,436.00 |
| 20/11/2008 | 89,014.00 |
| 21/11/2008 | 84,340.00 |
| 22/11/2008 | 100,000.00 |
| 23/11/2008 | 87,054.00 |
| 24/11/2008 | 91,206.00 |
| 25/11/2008 | 90,604.00 |
| 26/11/2008 | 81,302.00 |
| 27/11/2008 | 90,738.00 |
| 28/11/2008 | 95,290.00 |
| 29/11/2008 | 99,140.00 |
| 30/11/2008 | 85,342.00 |

[Reporte en formato texto](#)

1/3/2010 11:15:05 AM

XM Compañía de Expertos en Mercados S.A. ESP - Medellín, Colombia - Calle 12 Sur Nro 18 - 166 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170989 - Línea de Orientación a Clientes: 57(4)3172928

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1/3/2010 11:15:32 AM

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|-----------|
| 01/12/2008 | 93,318.00 |
| 02/12/2008 | 96,326.00 |
| 03/12/2008 | 86,216.00 |
| 04/12/2008 | 65,032.00 |
| 05/12/2008 | 26,934.00 |
| 06/12/2008 | 99,182.00 |
| 07/12/2008 | 29,810.00 |
| 08/12/2008 | 40,772.00 |
| 09/12/2008 | 86,696.00 |
| 10/12/2008 | 95,062.00 |
| 11/12/2008 | 92,808.00 |
| 12/12/2008 | 94,070.00 |
| 13/12/2008 | 94,156.00 |
| 14/12/2008 | 57,928.00 |
| 15/12/2008 | 87,846.00 |
| 16/12/2008 | 48,068.00 |
| 17/12/2008 | 92,620.00 |
| 18/12/2008 | 87,278.00 |
| 19/12/2008 | 83,550.00 |
| 20/12/2008 | 90,188.00 |
| 21/12/2008 | 26,546.00 |
| 22/12/2008 | 66,114.00 |
| 23/12/2008 | 90,244.00 |
| 24/12/2008 | 78,682.00 |
| 25/12/2008 | 0.00 |
| 26/12/2008 | 0.00 |
| 27/12/2008 | 0.00 |
| 28/12/2008 | 0.00 |
| 29/12/2008 | 49,530.00 |
| 30/12/2008 | 86,936.00 |
| 31/12/2008 | 70,422.00 |

Reporte en formato texto

1/3/2010 11:15:33 AM

XM Compañía de Expertos en Mercados S.A. ESP. - Medellín, Colombia - Calle 12 Sur Nro 18 - 188 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170989 - Línea de Orientación a Clientes: 57(4)3172929

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1/3/2010 11:16:07 AM

Información generada por Neón entre 01/01/2009 y 31/01/2009 [DD/MM/YYYY]

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/01/2009 | 0.00 |
| 02/01/2009 | 0.00 |
| 03/01/2009 | 0.00 |
| 04/01/2009 | 0.00 |
| 05/01/2009 | 52,900.00 |
| 06/01/2009 | 57,462.00 |
| 07/01/2009 | 48,680.00 |
| 08/01/2009 | 79,564.00 |
| 09/01/2009 | 78,928.00 |
| 10/01/2009 | 78,434.00 |
| 11/01/2009 | 0.00 |
| 12/01/2009 | 0.00 |
| 13/01/2009 | 57,798.00 |
| 14/01/2009 | 85,844.00 |
| 15/01/2009 | 87,076.00 |
| 16/01/2009 | 70,580.00 |
| 17/01/2009 | 0.00 |
| 18/01/2009 | 0.00 |
| 19/01/2009 | 0.00 |
| 20/01/2009 | 0.00 |
| 21/01/2009 | 0.00 |
| 22/01/2009 | 0.00 |
| 23/01/2009 | 0.00 |
| 24/01/2009 | 0.00 |
| 25/01/2009 | 47,908.00 |
| 26/01/2009 | 114,080.00 |
| 27/01/2009 | 80,766.00 |
| 28/01/2009 | 104,548.00 |
| 29/01/2009 | 118,980.00 |
| 30/01/2009 | 119,006.00 |
| 31/01/2009 | 112,672.00 |

Reporte en formato texto

1/3/2010 11:16:09 AM

XM Compañía de Expertos en Mercados S.A. ESP. - Medellín, Colombia - Calle 12 Sur Nro 18 - 168 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170289 - Línea de Orientación a Clientes: 57(4)3172929

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1/3/2010 11:16 52 AM

Información generada por Neón entre 01/02/2009 y 28/02/2009 [DD/MM/YYYY]

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/02/2009 | 101,066.00 |
| 02/02/2009 | 117,198.00 |
| 03/02/2009 | 45,708.00 |
| 04/02/2009 | 46,524.00 |
| 05/02/2009 | 117,096.00 |
| 06/02/2009 | 124,848.00 |
| 07/02/2009 | 125,966.00 |
| 08/02/2009 | 112,088.00 |
| 09/02/2009 | 124,064.00 |
| 10/02/2009 | 88,192.00 |
| 11/02/2009 | 105,784.00 |
| 12/02/2009 | 120,108.00 |
| 13/02/2009 | 117,858.00 |
| 14/02/2009 | 118,308.00 |
| 15/02/2009 | 109,288.00 |
| 16/02/2009 | 85,482.00 |
| 17/02/2009 | 107,322.00 |
| 18/02/2009 | 120,320.00 |
| 19/02/2009 | 120,646.00 |
| 20/02/2009 | 119,748.00 |
| 21/02/2009 | 124,770.00 |
| 22/02/2009 | 116,056.00 |
| 23/02/2009 | 121,608.00 |
| 24/02/2009 | 122,650.00 |
| 25/02/2009 | 123,178.00 |
| 26/02/2009 | 112,590.00 |
| 27/02/2009 | 41,616.00 |
| 28/02/2009 | 123,770.00 |

Reporte en formato texto

1/3/2010 11:16 52 AM

XM Compañía de Expertos en Mercados S.A. ESP - Medellín, Colombia - Calle 12 Sur Nro 16 - 166 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170989 - Línea de Orientación a Clientes: 57(4)3172029

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1/3/2010 11:17:22 AM

Información generada por Neón entre 01/03/2009 y 31/03/2009 [DD/MM/YYYY]

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/03/2009 | 109,042.00 |
| 02/03/2009 | 123,216.00 |
| 03/03/2009 | 125,130.00 |
| 04/03/2009 | 124,276.00 |
| 05/03/2009 | 129,602.00 |
| 06/03/2009 | 133,152.00 |
| 07/03/2009 | 134,596.00 |
| 08/03/2009 | 89,672.00 |
| 09/03/2009 | 114,516.00 |
| 10/03/2009 | 122,664.00 |
| 11/03/2009 | 125,558.00 |
| 12/03/2009 | 128,266.00 |
| 13/03/2009 | 100,034.00 |
| 14/03/2009 | 112,388.00 |
| 15/03/2009 | 130,052.00 |
| 16/03/2009 | 132,066.00 |
| 17/03/2009 | 127,776.00 |
| 18/03/2009 | 124,068.00 |
| 19/03/2009 | 132,392.00 |
| 20/03/2009 | 125,314.00 |
| 21/03/2009 | 119,056.00 |
| 22/03/2009 | 91,916.00 |
| 23/03/2009 | 95,762.00 |
| 24/03/2009 | 105,764.00 |
| 25/03/2009 | 91,070.00 |
| 26/03/2009 | 128,776.00 |
| 27/03/2009 | 129,444.00 |
| 28/03/2009 | 136,578.00 |
| 29/03/2009 | 123,894.00 |
| 30/03/2009 | 120,358.00 |
| 31/03/2009 | 121,180.00 |

[Reporte en formato texto](#)

1/3/2010 11:17:22 AM

XM Compañía de Expertos en Mercados S.A. ESP. - Medellín, Colombia - Calle 12 Sur Nro 18 - 188 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170989 - Línea de Orientación a Clientes: 57(4)3172929

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1/3/2010 11:17:48 AM

Información generada por Neón entre 01/04/2009 y 30/04/2009 [DD/MM/YYYY]

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/04/2009 | 115,050.00 |
| 02/04/2009 | 113,290.00 |
| 03/04/2009 | 129,956.00 |
| 04/04/2009 | 134,698.00 |
| 05/04/2009 | 121,882.00 |
| 06/04/2009 | 132,926.00 |
| 07/04/2009 | 128,504.00 |
| 08/04/2009 | 138,708.00 |
| 09/04/2009 | 100,784.00 |
| 10/04/2009 | 14,086.00 |
| 11/04/2009 | 0.00 |
| 12/04/2009 | 0.00 |
| 13/04/2009 | 69,658.00 |
| 14/04/2009 | 139,870.00 |
| 15/04/2009 | 141,484.00 |
| 16/04/2009 | 143,916.00 |
| 17/04/2009 | 141,362.00 |
| 18/04/2009 | 144,504.00 |
| 19/04/2009 | 126,156.00 |
| 20/04/2009 | 141,314.00 |
| 21/04/2009 | 130,936.00 |
| 22/04/2009 | 133,168.00 |
| 23/04/2009 | 130,384.00 |
| 24/04/2009 | 136,688.00 |
| 25/04/2009 | 145,260.00 |
| 26/04/2009 | 105,922.00 |
| 27/04/2009 | 105,820.00 |
| 28/04/2009 | 108,140.00 |
| 29/04/2009 | 141,770.00 |
| 30/04/2009 | 134,012.00 |

[Reporte en formato texto](#)

1/3/2010 11:17:48 AM

XM Compañía de Expertos en Mercados S.A. ESP. - Medellín, Colombia - Calle 12 Sur Nro 18 - 168 Bique 2

PBX: 57(4)3172244 - FAX: 57(4)3170989 - Línea de Orientación a Clientes: 57(4)3172929

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1/3/2010 11:18:22 AM

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/05/2009 | 126,290.00 |
| 02/05/2009 | 121,468.00 |
| 03/05/2009 | 120,634.00 |
| 04/05/2009 | 138,854.00 |
| 05/05/2009 | 144,170.00 |
| 06/05/2009 | 138,434.00 |
| 07/05/2009 | 134,274.00 |
| 08/05/2009 | 83,334.00 |
| 09/05/2009 | 141,378.00 |
| 10/05/2009 | 131,992.00 |
| 11/05/2009 | 140,050.00 |
| 12/05/2009 | 142,798.00 |
| 13/05/2009 | 140,962.00 |
| 14/05/2009 | 143,110.00 |
| 15/05/2009 | 140,220.00 |
| 16/05/2009 | 142,794.00 |
| 17/05/2009 | 130,484.00 |
| 18/05/2009 | 139,252.00 |
| 19/05/2009 | 140,560.00 |
| 20/05/2009 | 144,074.00 |
| 21/05/2009 | 133,310.00 |
| 22/05/2009 | 143,238.00 |
| 23/05/2009 | 139,822.00 |
| 24/05/2009 | 118,204.00 |
| 25/05/2009 | 92,628.00 |
| 26/05/2009 | 115,898.00 |
| 27/05/2009 | 143,112.00 |
| 28/05/2009 | 142,200.00 |
| 29/05/2009 | 140,666.00 |
| 30/05/2009 | 146,130.00 |
| 31/05/2009 | 129,988.00 |

Reporte en formato texto

1/3/2010 11:18:22 AM

XM Compañía de Expertos en Mercados S.A. ESP - Medellín, Colombia - Calle 12 Sur Nro 18 - 168 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170889 - Línea de Orientación a Clientes: 57(4)3172929

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1/3/2010 11:18:56 AM

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/06/2009 | 140,094.00 |
| 02/06/2009 | 143,518.00 |
| 03/06/2009 | 144,216.00 |
| 04/06/2009 | 136,446.00 |
| 05/06/2009 | 100,402.00 |
| 06/06/2009 | 128,884.00 |
| 07/06/2009 | 128,222.00 |
| 08/06/2009 | 138,668.00 |
| 09/06/2009 | 136,296.00 |
| 10/06/2009 | 132,898.00 |
| 11/06/2009 | 131,074.00 |
| 12/06/2009 | 132,290.00 |
| 13/06/2009 | 130,620.00 |
| 14/06/2009 | 107,366.00 |
| 15/06/2009 | 98,196.00 |
| 16/06/2009 | 142,874.00 |
| 17/06/2009 | 141,510.00 |
| 18/06/2009 | 139,754.00 |
| 19/06/2009 | 141,158.00 |
| 20/06/2009 | 135,468.00 |
| 21/06/2009 | 110,134.00 |
| 22/06/2009 | 113,252.00 |
| 23/06/2009 | 132,492.00 |
| 24/06/2009 | 121,554.00 |
| 25/06/2009 | 76,456.00 |
| 26/06/2009 | 0.00 |
| 27/06/2009 | 61,874.00 |
| 28/06/2009 | 102,450.00 |
| 29/06/2009 | 83,066.00 |
| 30/06/2009 | 124,162.00 |

Reporte en formato texto

1/3/2010 11:18:57 AM

XM Campaña de Expertos en Mercados S.A. ESP. - Medellín, Colombia - Calle 12 Sur Nro 18 - 168 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170988 - Línea de Orientación a Clientes: 57(4)3172929

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1/3/2010 11:19:21 AM

Información generada por Neón entre 01/07/2009 y 31/07/2009 [DD/MM/YYYY]

GENERACION DE MENORES

(kWh)

MENOR SANTA ANA

Central

| | |
|------------|------------|
| 01/07/2009 | 133,002.00 |
| 02/07/2009 | 117,336.00 |
| 03/07/2009 | 130,170.00 |
| 04/07/2009 | 123,306.00 |
| 05/07/2009 | 0.00 |
| 06/07/2009 | 0.00 |
| 07/07/2009 | 85,340.00 |
| 08/07/2009 | 49,744.00 |
| 09/07/2009 | 36,060.00 |
| 10/07/2009 | 130,366.00 |
| 11/07/2009 | 126,778.00 |
| 12/07/2009 | 116,782.00 |
| 13/07/2009 | 131,668.00 |
| 14/07/2009 | 136,838.00 |
| 15/07/2009 | 132,388.00 |
| 16/07/2009 | 134,780.00 |
| 17/07/2009 | 132,372.00 |
| 18/07/2009 | 39,236.00 |
| 19/07/2009 | 0.00 |
| 20/07/2009 | 0.00 |
| 21/07/2009 | 0.00 |
| 22/07/2009 | 52,610.00 |
| 23/07/2009 | 113,106.00 |
| 24/07/2009 | 115,648.00 |
| 25/07/2009 | 123,672.00 |
| 26/07/2009 | 105,556.00 |
| 27/07/2009 | 109,630.00 |
| 28/07/2009 | 111,202.00 |
| 29/07/2009 | 110,630.00 |
| 30/07/2009 | 110,132.00 |
| 31/07/2009 | 110,546.00 |

Reporte en formato texto

1/3/2010 11:19:22 AM

XM Compañía de Expertos en Mercados S.A. ESP - Medellín, Colombia - Calle 12 Sur Nro 18 - 103 Bloque 2

PBX: 57(4)3172244 - FAX: 57(4)3170989 - Línea de Orientación a Clientes: 57(4)3172929

info@xm.com.co - www.xm.com.co