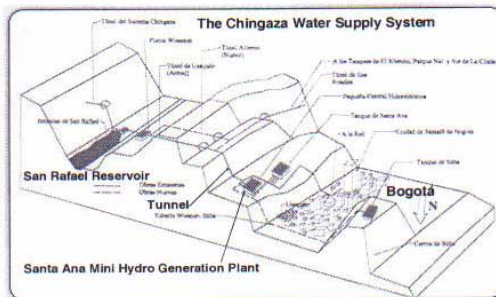




**acueducto**  
AGUA Y ALCANTARILLADO DE BOGOTÁ

## SANTA ANA HYDROELECTRIC PLANT




### A SMALL-SCALE CDM PROJECT



**MONITORING REPORT OF CO<sub>2</sub> EMISSIONS REDUCTIONS  
ACHIEVED DURING THE FIRST ACCREDITATION PERIOD,  
August 1, 2005 – July 31, 2006**

**October 27, 2006**

Version: 1

It has been prepared by:	It has been reviewed by:	It has been approved by:
		
Martha Cruz	German Galindo	Oscar Garcia
CDM Team Leader, Environment Area	Manager, Environment Area	Corporate Manager of the EAAB Master System

## 1. Objectives of this Monitoring Report

The regulatory framework of the UNFCCC requires that the emissions reductions from duly registered CDM projects be reviewed and verified by an Designated Operational Entity (DOE), in order for UNFCCC to Certify the CO<sub>2e</sub> emissions reductions. The Monitoring Report, Verification and Certification are required to enable the UNFCCC to emit with precision the number of Certificates of Emission Reduction due to the CDM project. This monitoring report was prepared in the most precise and conservative manner possible, in order to document the amount of CO<sub>2e</sub> displaced from the interconnected grid by the Santa Ana Hydroelectric Plant during its first accreditation period, from August 1, 2005 – July 31, 2006.

The PDD of the Santa Ana Hydroelectric Plant was duly validated by the DOE *TUV Industrie Service GMBH SUD Group*, and was officially registered as a Small Scale CDM project by the CDM Executive Board.

Colombian Institute for Technical Standards and Certification - ICONTEC, a DOE with Indicative Letter, was retained by the *Empresa de Acueducto y Alcantarillado de Bogotá (EAAB)*, the only owner and project participant, for the official Verification of the CO<sub>2e</sub> emissions reduced by the CDM project after its first accreditation period.

## 2. Description of the Project

The Santa Ana Hydroelectric Plant has a installed electricity generation capacity of 13.43 MW. This plant was built and is operated by *EAAB*, the Municipal Water Utility Company of the city of Bogotá, Colombia. The plant is located on the outskirts of the city. The coordinates are Latitude 110-360 North, Longitude 105-800 East, specified as Cartesian Coordinates, at 2,750 meters above sea level.

The Santa Ana Hydroelectric Plant receives its water flow by gravity from the Wiesner Drinking Water Plant located 106 meters above on the mountain range. It channels the water flowing in with the force of gravity through a Francis turbine, generating clean electricity, and then the water is sent to the water distribution system of the city of Bogotá. The electrical energy is delivered into the national interconnected electricity grid, in full compliance with all laws and regulatory requirements. A key objective of the project is to reduce CO<sub>2e</sub> emissions from the national interconnected grid.

The project's specifications are:

Installed Plate Capacity of the Turbine:	13.43 MW
Plant design flow:	13.5 m <sup>3</sup> /s
Net Design Head	105.90 m
Hydraulic Turbine	Francis NEIRPIC, produced by ALSTON Hydro, Barcelona
Expected Annual Generation	47 GWh/year

### **3. Implementation and Operation of the Project during the First Accreditation Period**

The plant began operating the 10 of June 2005 and it has functioned normally to the date. The period from June 10 up to July 31, 2005, corresponds to the period of testing and adjustments.

The Accreditation period for the calculation of the CO<sub>2e</sub> emissions reductions was established in the Registered PDD to begin August 1, 2005, and to end on July 31, 2006.

The protocol for measurement of energy generated and the official small scale emissions reduction factor were also included in the PDD and validated by *TUV Industrie Service GMBH SUD Group*. The monitoring protocol was implemented carefully.

The measurement of the electricity effectively delivered into the national interconnected grid, which is the most conservative basis for the calculation of the CO<sub>2e</sub> emissions reductions, is done daily at the point of interconnection. The technical procedures that are applied for the measurement of the electricity effectively delivered to the grid, are included in Resolution 006 of 2003 of the *Comisión de Regulación de Agua Potable y Saneamiento Básico (CRA)* of Colombia.

### **4. Data on Electricity Generation and Estimation of Emissions Reductions during the First Accreditation Period**

The three entities which are responsible for measuring and verifying the amount of electricity which is effectively delivered into the national interconnected grid from the Santa Ana Hydroelectric Plant, confirm that the amount of electricity effectively delivered to the grid during the first accreditation period was 54,553,539 KWh. The three entities responsible for precise and conservative measurement of the electricity delivered into the grid are:

- *EMGESA (Empresa Generadora de Energía Eléctrica S.A.)*, is the firm that markets the energy generated by Santa Ana Hydroelectric Plant.
- *CODENSA, (Comercializador y Distribuidor de Energía Eléctrica S.A.)*, is the entity that operates the local interconnected grid.
- *EAAB (Empresa de Acueducto y Alcantarillado de Bogotá – E.S.P.)*, is the firm that owns and operates the Santa Ana Hydroelectric Plant.

The consensus of these three entities regarding the amount of electricity which is effectively delivered into the national grid is published on the web page of the *Compañía de Expertos en Mercados S.A. – E.S.P.*<sup>1</sup>

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<sup>1</sup> Appendix 1. The daily data of electricity generated by Santa Ana Hydroelectric Plant from the web page <http://sv04.xm.com.co/neonweb/>

The amount of electricity delivered to the grid from Santa Ana Hydroelectric Plant, verified by these three entities and published on the web page, are presented in Table 1.

The official emissions reductions factor for small scale CDM projects interconnected to Colombia's national grid, which was duly validated by the DOE *TUV Industrie Service GMBH SUD Group* and included in the PDD that was duly Registered by the UNFCCC, is **0.4392 kg CO<sub>2</sub>e per KWh delivered to the grid**. This emission factor was calculated for the *Unidad de Planeación Minero Energética (UPME)* of Colombia and is included in the National Expansion Plan for Electricity Sector 2005 – 2019<sup>2</sup>.

Table 1. Electricity Delivered to the National Interconnected Grid and Estimation of CO <sub>2</sub> Emissions Reduced			
Period	Electricity (KW/h)	Emissions Reduced (Kg CO <sub>2</sub> e)	Emissions Reduced (Ton CO <sub>2</sub> e)
Aug-2005	4,912,249	2,157,460	2,157
Sept-2005	4,909,220	2,156,129	2,156
Oct-2005	4,823,754	2,118,593	2,119
Nov-2005	4,327,649	1,900,703	1,901
Dec-2005	4,667,557	2,049,991	2,050
Jan-2006	4,373,164	1,920,694	1,921
Feb-2006	4,245,280	1,864,527	1,865
Mar-2006	4,517,868	1,984,248	1,984
Apr-2006	3,795,798	1,667,114	1,667
May-2006	4,803,396	2,109,652	2,110
Jun-2006	4,344,584	1,908,141	1,908
Jul-2006	4,833,020	2,122,662	2,123
<b>Total</b>	<b>54,553,539</b>	<b>23,959,914</b>	<b>23,960</b>

## 5. Environmental and Social Aspects of the First Year of Operation.

This small scale renewable energy project is not related to any additional construction of major infrastructure, dams nor roads, and will not disturb any human settlements. Classified as a run-of-the-river system, the Santa Ana Hydroelectric Plant does not generate any negative environmental or social impacts. The project was carefully consulted with neighboring

<sup>2</sup> Ministry of Mines and Energy. *Unidad de Planeación Minero Energética (UPME): Simplify Methodology for the Calculation of Base Lines for Small Scale CDM Projects for Generation of Electrical Energy with Renewable Sources Interconnect to the Grid for year 2004*. October, 2005.



stakeholders and community residents. The project is an incremental investment project built onto the previously existing infrastructure for water supplies of the City of Bogotá.

The facility was granted all environmental permits and licenses required by national and regional environmental laws and regulations.

The project is generating a range of benefits associated with small scale renewable energy. In addition to reducing greenhouse gases, the project's displacement of fossil electricity generation from the grid (typically coal) will also cut local contaminants such as heavy and small particulates, SO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub> and heavy metals, when coal-fired generation is displaced.

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Información generada por Neón entre 01/08/2005 y 31/07/2006 [DD/MM/YYYY]	GENERACION DE MENORES
	(kWh)
	PLANTA MENOR SANTA ANA
	Central
01/08/2005	177,836.00
02/08/2005	171,862.00
03/08/2005	168,202.00
04/08/2005	174,310.00
05/08/2005	173,880.00
06/08/2005	169,946.00
07/08/2005	159,872.00
08/08/2005	159,858.00
09/08/2005	64,801.00
10/08/2005	161,866.00
11/08/2005	161,916.00
12/08/2005	163,634.00
13/08/2005	159,930.00
14/08/2005	149,154.00
15/08/2005	130,318.00
16/08/2005	165,930.00
17/08/2005	155,990.00
18/08/2005	140,900.00
19/08/2005	163,782.00
20/08/2005	163,286.00
21/08/2005	156,478.00
22/08/2005	162,842.00
23/08/2005	157,602.00
24/08/2005	160,644.00
25/08/2005	164,612.00
26/08/2005	144,902.00
27/08/2005	163,370.00
28/08/2005	163,360.00
29/08/2005	166,254.00
30/08/2005	167,620.00
31/08/2005	167,292.00

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Información generada por Neón entre 01/08/2005 y 31/07/2006 [DD/MM/YYYY]

GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/09/2005	159,802.00
02/09/2005	164,166.00
03/09/2005	167,844.00
04/09/2005	164,640.00
05/09/2005	163,826.00
06/09/2005	167,350.00
07/09/2005	167,160.00
08/09/2005	163,928.00
09/09/2005	150,332.00
10/09/2005	166,694.00
11/09/2005	161,956.00
12/09/2005	166,470.00
13/09/2005	166,178.00
14/09/2005	164,028.00
15/09/2005	164,206.00
16/09/2005	165,834.00
17/09/2005	168,876.00
18/09/2005	160,532.00
19/09/2005	150,126.00
20/09/2005	166,408.00
21/09/2005	163,406.00
22/09/2005	166,526.00
23/09/2005	168,044.00
24/09/2005	166,246.00
25/09/2005	152,698.00
26/09/2005	167,456.00
27/09/2005	162,010.00
28/09/2005	164,370.00
29/09/2005	162,568.00
30/09/2005	165,540.00

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GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/10/2005	163,752.00
02/10/2005	155,522.00
03/10/2005	155,340.00
04/10/2005	156,520.00
05/10/2005	141,942.00
06/10/2005	158,930.00
07/10/2005	165,736.00
08/10/2005	163,290.00
09/10/2005	165,560.00
10/10/2005	166,592.00
11/10/2005	167,184.00
12/10/2005	167,562.00
13/10/2005	166,320.00
14/10/2005	167,500.00
15/10/2005	132,966.00
16/10/2005	151,942.00
17/10/2005	157,536.00
18/10/2005	172,680.00
19/10/2005	172,544.00
20/10/2005	171,636.00
21/10/2005	173,072.00
22/10/2005	155,352.00
23/10/2005	161,996.00
24/10/2005	167,858.00
25/10/2005	166,330.00
26/10/2005	165,764.00
27/10/2005	166,618.00
28/10/2005	171,206.00
29/10/2005	171,616.00
30/10/2005	102,888.00
31/10/2005	0.00

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Información generada por Neón entre 01/08/2005 y 31/07/2006 [DD/MM/YYYY]

GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/11/2005	0.00
02/11/2005	0.00
03/11/2005	1,736.00
04/11/2005	173,300.00
05/11/2005	162,931.00
06/11/2005	147,719.00
07/11/2005	154,445.00
08/11/2005	178,411.00
09/11/2005	170,983.00
10/11/2005	164,753.00
11/11/2005	171,645.00
12/11/2005	144,617.00
13/11/2005	140,905.00
14/11/2005	145,034.00
15/11/2005	160,933.00
16/11/2005	167,437.00
17/11/2005	179,072.00
18/11/2005	105,663.00
19/11/2005	170,039.00
20/11/2005	166,705.00
21/11/2005	170,676.00
22/11/2005	173,486.00
23/11/2005	167,707.00
24/11/2005	165,137.00
25/11/2005	166,420.00
26/11/2005	166,909.00
27/11/2005	146,200.00
28/11/2005	154,602.00
29/11/2005	164,710.00
30/11/2005	145,474.00

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Información generada por Neón entre 01/08/2005 y 31/07/2006 [DD/MM/YYYY]

GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/12/2005	164,412.00
02/12/2005	170,515.00
03/12/2005	164,006.00
04/12/2005	155,628.00
05/12/2005	167,767.00
06/12/2005	168,644.00
07/12/2005	159,017.00
08/12/2005	145,565.00
09/12/2005	159,696.00
10/12/2005	169,753.00
11/12/2005	155,540.00
12/12/2005	159,950.00
13/12/2005	43,528.00
14/12/2005	98,636.00
15/12/2005	180,758.00
16/12/2005	173,128.00
17/12/2005	170,314.00
18/12/2005	93,602.00
19/12/2005	87,420.00
20/12/2005	152,782.00
21/12/2005	158,694.00
22/12/2005	157,994.00
23/12/2005	161,050.00
24/12/2005	157,628.00
25/12/2005	138,670.00
26/12/2005	137,242.00
27/12/2005	150,606.00
28/12/2005	164,764.00
29/12/2005	173,038.00
30/12/2005	180,330.00
31/12/2005	146,880.00

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Información generada por Neón entre 01/08/2005 y 31/07/2006 [DD/MM/YYYY]

GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/01/2006	118,412.00
02/01/2006	131,336.00
03/01/2006	144,290.00
04/01/2006	150,542.00
05/01/2006	139,128.00
06/01/2006	123,284.00
07/01/2006	123,280.00
08/01/2006	115,274.00
09/01/2006	121,312.00
10/01/2006	142,864.00
11/01/2006	147,014.00
12/01/2006	145,800.00
13/01/2006	149,692.00
14/01/2006	151,904.00
15/01/2006	137,138.00
16/01/2006	117,148.00
17/01/2006	146,506.00
18/01/2006	148,302.00
19/01/2006	150,194.00
20/01/2006	148,282.00
21/01/2006	145,042.00
22/01/2006	138,466.00
23/01/2006	147,164.00
24/01/2006	147,808.00
25/01/2006	148,952.00
26/01/2006	139,766.00
27/01/2006	148,698.00
28/01/2006	137,788.00
29/01/2006	137,394.00
30/01/2006	167,640.00
31/01/2006	162,744.00

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GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/02/2006	156,336.00
02/02/2006	156,316.00
03/02/2006	150,728.00
04/02/2006	151,544.00
05/02/2006	148,432.00
06/02/2006	154,290.00
07/02/2006	137,906.00
08/02/2006	148,882.00
09/02/2006	151,214.00
10/02/2006	154,454.00
11/02/2006	152,486.00
12/02/2006	145,686.00
13/02/2006	155,470.00
14/02/2006	152,312.00
15/02/2006	155,580.00
16/02/2006	161,068.00
17/02/2006	161,686.00
18/02/2006	155,116.00
19/02/2006	151,882.00
20/02/2006	156,376.00
21/02/2006	135,794.00
22/02/2006	152,604.00
23/02/2006	156,152.00
24/02/2006	155,638.00
25/02/2006	153,828.00
26/02/2006	146,816.00
27/02/2006	132,816.00
28/02/2006	153,868.00

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GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/03/2006	155,370.00
02/03/2006	154,190.00
03/03/2006	157,816.00
04/03/2006	158,656.00
05/03/2006	153,154.00
06/03/2006	151,732.00
07/03/2006	153,322.00
08/03/2006	152,424.00
09/03/2006	151,856.00
10/03/2006	154,108.00
11/03/2006	150,566.00
12/03/2006	146,002.00
13/03/2006	144,626.00
14/03/2006	152,694.00
15/03/2006	152,984.00
16/03/2006	152,320.00
17/03/2006	104,832.00
18/03/2006	68,938.00
19/03/2006	140,120.00
20/03/2006	139,404.00
21/03/2006	150,496.00
22/03/2006	153,796.00
23/03/2006	152,260.00
24/03/2006	135,762.00
25/03/2006	150,714.00
26/03/2006	139,084.00
27/03/2006	151,852.00
28/03/2006	151,390.00
29/03/2006	151,362.00
30/03/2006	135,148.00
31/03/2006	150,890.00

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GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/04/2006	154,812.00
02/04/2006	151,620.00
03/04/2006	154,922.00
04/04/2006	156,590.00
05/04/2006	156,068.00
06/04/2006	155,930.00
07/04/2006	154,040.00
08/04/2006	84,280.00
09/04/2006	40,314.00
10/04/2006	144,862.00
11/04/2006	126,216.00
12/04/2006	77,910.00
13/04/2006	45,622.00
14/04/2006	79,172.00
15/04/2006	100,812.00
16/04/2006	136,820.00
17/04/2006	153,280.00
18/04/2006	154,716.00
19/04/2006	151,782.00
20/04/2006	143,024.00
21/04/2006	126,558.00
22/04/2006	148,514.00
23/04/2006	145,228.00
24/04/2006	150,840.00
25/04/2006	148,122.00
26/04/2006	143,764.00
27/04/2006	108,450.00
28/04/2006	46,166.00
29/04/2006	123,306.00
30/04/2006	132,058.00

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GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/05/2006	127,398.00
02/05/2006	133,808.00
03/05/2006	125,710.00
04/05/2006	150,930.00
05/05/2006	151,304.00
06/05/2006	151,442.00
07/05/2006	142,070.00
08/05/2006	152,768.00
09/05/2006	153,572.00
10/05/2006	149,108.00
11/05/2006	152,912.00
12/05/2006	160,830.00
13/05/2006	162,002.00
14/05/2006	163,478.00
15/05/2006	164,976.00
16/05/2006	153,772.00
17/05/2006	160,054.00
18/05/2006	158,380.00
19/05/2006	167,226.00
20/05/2006	179,506.00
21/05/2006	149,382.00
22/05/2006	177,170.00
23/05/2006	172,188.00
24/05/2006	167,766.00
25/05/2006	163,348.00
26/05/2006	148,802.00
27/05/2006	155,766.00
28/05/2006	139,374.00
29/05/2006	143,848.00
30/05/2006	164,106.00
31/05/2006	160,400.00

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Información generada por Neón entre 01/08/2005 y 31/07/2006 [DD/MM/YYYY]

GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/06/2006	146,106.00
02/06/2006	147,444.00
03/06/2006	146,764.00
04/06/2006	151,488.00
05/06/2006	152,038.00
06/06/2006	152,308.00
07/06/2006	96,744.00
08/06/2006	125,858.00
09/06/2006	130,690.00
10/06/2006	157,766.00
11/06/2006	153,424.00
12/06/2006	152,598.00
13/06/2006	134,596.00
14/06/2006	114,320.00
15/06/2006	121,036.00
16/06/2006	158,194.00
17/06/2006	152,488.00
18/06/2006	136,126.00
19/06/2006	136,350.00
20/06/2006	147,142.00
21/06/2006	150,226.00
22/06/2006	154,256.00
23/06/2006	155,958.00
24/06/2006	152,560.00
25/06/2006	136,768.00
26/06/2006	140,094.00
27/06/2006	156,816.00
28/06/2006	154,730.00
29/06/2006	164,134.00
30/06/2006	165,562.00

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Información generada por Neón entre 01/08/2005 y 31/07/2006 [DD/MM/YYYY]

GENERACION DE MENORES  
(kWh)  
PLANTA MENOR SANTA ANA  
Central

01/07/2006	164,302.00
02/07/2006	151,110.00
03/07/2006	132,376.00
04/07/2006	157,788.00
05/07/2006	169,440.00
06/07/2006	168,776.00
07/07/2006	170,694.00
08/07/2006	169,714.00
09/07/2006	152,386.00
10/07/2006	163,300.00
11/07/2006	170,348.00
12/07/2006	170,428.00
13/07/2006	169,522.00
14/07/2006	145,024.00
15/07/2006	164,968.00
16/07/2006	142,954.00
17/07/2006	150,030.00
18/07/2006	159,230.00
19/07/2006	176,346.00
20/07/2006	147,714.00
21/07/2006	152,602.00
22/07/2006	154,150.00
23/07/2006	143,062.00
24/07/2006	147,388.00
25/07/2006	148,964.00
26/07/2006	150,176.00
27/07/2006	153,190.00
28/07/2006	146,434.00
29/07/2006	149,000.00
30/07/2006	139,356.00
31/07/2006	152,248.00

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