CDM SMALL-SCALE PROJECT ACTIVITIES BUNDLING FORM **(F-CDM-SSC-BUN)**
Version 03.0

Title of the bundle	Suba and Usaquen hydroelectric CDM umbrella project
Version number of the completed F-CDM-SSC-BUN	01.0
Completion date of the F-CDM-SSC-BUN	30/10/2013
Title of the project activities in the bundle	Suba hydroelectric power plant Usaquen hydroelectric power plant
Version number of the project design document(s) (PDD(s)) of the project activities	04.0
Completion date of the PDD(s)	21/10/2013

SECTION A. Description of bundle and subbundles

A.1. General description of project activities in bundle

The project activity contemplates the production of clean hydroelectric power using a flow of water by means of the installation of two small run-of-river hydroelectric plants (Suba and Usaquen) with a total installed capacity of 4.36 MW[1] (rated capacity of generators[2]), in the water supply system of Bogota, Department of Cundinamarca. The energy generated will be sold to the National Interconnected System of Colombia.

For each power plant to be installed, the water will be derived from the main conduction pipeline (potable water supply system) in the point adjacent to the flow control valve. The derivation will be made by the installation of an accessory, driving the water through a closed steel pipeline, to a pressurized conduction penstock and up to the distributor where the flow is directed to horizontal Francis turbines. Each turbine will be hosted in a power house, with their respective generators, valves and control panels. A power substation will be located besides each power house. As the project plants are run-of-river hydro taking water from an existing water supply system, it is not necessary to build a reservoir.

The entire project will generate electricity for the Colombian power grid without greenhouse gases (GHG) emissions. The power plants (Suba and Usaquen) will have a total effective capacity of 3.77 MW[3] (rated capacity of turbine-generator system); with an estimated power supply to the grid of 27,349 MWh per year (both power plants)[4]. Thus, the project will increase the supply of electricity to the grid, partially displacing thermal generation with a renewable source of energy, and consequently reducing GHG emissions. The project will reduce 10,424 tCO_2e/year and approximate reduction of 72,968 tCO_2e for the entire first crediting period (7 years).

The project is being implemented by Empresa de Acueducto y Alcantarillado de Bogotá (EAAB), a public utility created in 1995 with the purpose of managing the water supply and wastewater treatment in Bogotá. The design, engineering, construction and installation of the project is carried out by the engineering company Consorcio Generación Bogotá.

The participants of the project recognize that this project activity is helping Colombia to fulfil its goals of promoting sustainable development. Furthermore, the project is in line with host-country specific clean development mechanism (CDM) requirements because it:

- Contributes to local environmental sustainability;
- Contributes towards better working conditions and increases employment opportunities in the area where the project is located replacement of fossil fuels for energy generation, resulting in the reduction of GHG and other pollutants that affect people's health;
- Increases of electricity generation from renewable sources;
- Increases of the reliability of the Colombian Power System;

[1] This value is determined according to the provisions of "General guidelines to SSC CDM methodologies" in which the rated/installed capacity for renewable electricity generating units that involve turbine-generator systems shall be based on the installed/rated capacity of generator according to the manufacturer´s specification. Please refer rated capacity at equipment's nameplate.

[2] Please refer specifications determined on the nameplate for each generator (Generators INDAL).

[3] This value corresponds to the effective power ratings which is the maximum output of the system turbine-generator-connection (the turbine capacity is smaller than the generator and transformer capacity) based on the installed/rated capacity of turbines, generator and transformers considering their efficiencies according to the manufacturer´s specification. Please refer to the spreadsheet "Effective power ratings" on file "140113_EAAB emission reductions calculation V2_Revisión 3".

4 Please refer the spreadsheet "Power generation" on file "1401132_EAAB emission reductions calculation V2_Revisión 3".

- positive social impacts due to new employment during the construction, operation, and maintenance of the project activity;
- Adequate and sustainable use of hydrological resources;
- Contributes to development of technological capacity because all technology, man power and technical maintenance will be provided locally in the country;
- Additional public revenue which will generate local and national benefits;

Increases the contribution of small scale hydroelectricity projects to electricity generation in the region, and therefore, it may encourage other similar companies that want to replicate this kind of projects

Project activity	Type (I, II or III)	Methodology(ies)	Technology(ies) / Measure(s)
Suba hydroelectric power plant	I	AMS.I.D *"Grid connected renewable electricity generation"* – Version 17	The project activity contemplates the production of clean hydroelectric power using the water from the potable water supply system of Bogotá; therefore the technology/measure for the project corresponds to the equipment used for water diversion and energy generation / transmission
Usaquen hydroelectric power plant	I	AMS.I.D *"Grid connected renewable electricity generation"* – Version 17	The project activity contemplates the production of clean hydroelectric power using the water from the potable water supply system of Bogotá; therefore the technology/measure for the project corresponds to the equipment used for water diversion and energy generation / transmission

A.2. Location of project activities in bundle

Project activity	Host Party(ies)	Region/State/ Province	City/Town/ Community	Physical/ Geographical location
Suba hydroelectric power plant	Colombia	Cundinamarca	Bogotá	The project is composed by one hydroelectric power plant which will use potable water along the potable water supply system of Bogota. The coordinates for the physical location of the power house (Cartesian coordinate system) are: Lat 4.7120° Long -74.0836°
Usaquen hydroelectric power plant	Colombia	Cundinamarca	Bogotá	The project is composed by one hydroelectric power plant which will use potable water along the potable water supply system of Bogota. The coordinates for the physical location of the power house (Cartesian coordinate system) are: Lat 4.6920°

				Long -74.0381°

A.3. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host) accessed the Kyoto Protocol on 2001	*Empresa de Acueducto y Alcantarillado de Bogotá E.S.P-EAAB. (Public Company)*	*NO*

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage (tCO_2e)	Emission Reductions (tCO_2e)
2013*	8,687	0	0	8,687
2014	10,424	0	0	10,424
2015	10,424	0	0	10,424
2016	10,424	0	0	10,424
2017	10,424	0	0	10,424
2018	10,424	0	0	10,424
2019	10,424	0	0	10,424
2020**	1,737	0	0	1,737
Total	72,968	0	0	72,968
Total number of crediting years	7			
Annual average over the crediting period	10,424			

B.2. Monitoring plan

Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$ ($EG_{BL,y}$)
Unit	MWh/year
Description	Net electricity generated and supplied to the grid by the project activity in the year *y*.
Source of data	Measurement by project participant (power meters).
Value(s) applied	Net energy generation (average for the first crediting period) used for ex-ante estimation:

Power plant	MWh/yr
Suba hydroelectric power plant	17,012
Usaquen hydroelectric power plant	10,337
Total	27,349

	Note: Please refer the spreadsheet "power generation" on file "230413_EAAB emission reductions calculation V2_Revision 4".
Measurement methods and procedures	For each power plant, the net electricity export/supplied to a grid will be measured continuously and periodically recorded (records of any energy generated would be registered since the start of project). According to the provisions of AMS.I-D version 17, the net electricity export/supplied to a grid is the difference between the measured quantities of the grid electricity export and the import, thus in the project power plants the energy exported and imported will be measured (the net electricity supplied to the grid will be determined as the measured quantities of the grid electricity delivered to the grid minus the auxiliary electricity consumption, technical losses and electricity imports from the grid to each project power plant, determined in the commercial border or connection point used for billing purposes). Power meters will be installed in the project installations (for both, energy exported/supplied and energy imported from the grid). The measurements will be compiled at least hourly and stored in a specific spreadsheet (for each power plant).
Monitoring frequency	Measured continuously and periodically recorded
QA/QC procedures	Power meters will be calibrated periodically according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer's specifications (at least once every two years). Data collected has low uncertainty levels and to guarantee its accuracy it will be cross checked with records of invoices/receipts for sold/purchased electricity obtained from the grid trader/generator (where applicable, the low value would be used for emission reductions calculation. This is conservative). To ensure the information of each power plant, the grid trader/generator will deliver sales receipt separately (for Suba and Usaquén). The accuracy of the meters (+/- % readings 1s) are voltage 0.1%, frequency 0.01%, current (I1,I2,I3) 0,1% and current (I4, I5) 0.4%.
Purpose of data	Estimation of baseline emissions.
Additional comment	Data will be archived at least for two years after the crediting period.

Other elements of the monitoring plant

A monitoring plan will be implemented to ensure that the approved monitoring methodology AMS-I.D version 17 is correctly implemented in order to enable the accurate and transparent determination of emission reductions. The plan will incorporate the QA/QC procedures described in B.7.1 above , which are in line with the quality control system of EAAB. The overall management structure responsible for project monitoring is as follows:

Management monitoring structure: The project's structure for the management plan is as flows:

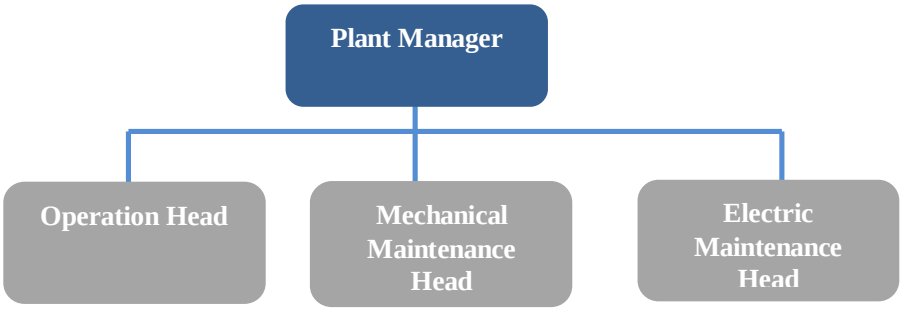

Figure: Monitoring management proposed structure

- **Plant Manager:** will be responsible for the following activities:
  - Supervise and guarantee the quality of the data registered in the spreadsheets.
  - Supervise and guarantee the quality of the annual and monthly final reports.
  - File the data and final reports.
  - Will have knowledge of the activities and calibration and maintenance of the equipment and will file the certificates of the procedure.

- **Operation Head:** will be responsible for the following activities:
  - Supervise and guarantee the quality of the data during their compilation process.
  - Compare the registered data to other available documents (bills, official information, formal communications of the electricity sector and other entities, among others).
  - File the data and final reports.
  - Process the data and generate the final reports.

- **Mechanical Maintenance Head:** will be responsible for performing the periodic revisions of equipment and when required, help with the calibrations and repairs of the equipment.

- **Electric Maintenance Head**: will be responsible for informing the requirements of inspection for calibration and maintenance of the equipment and filing the certificates of the procedure.

On-line monitoring system: All key meters required to determine parameters to calculate GHG emission reductions will be monitored from a central control point which will record meters readings at a pre-determined interval as specified in the project documents. These data will be used to continually update total emission reductions as long as the generating plant is in operation. Key meters will measure the parameters listed in B.7.1 above. Data collected has low uncertainty levels and to guarantee its accuracy it will be cross checked with the electricity sales receipts obtained from the grid trader/generator (where applicable, the low value would be used for emission reductions calculation. This is conservative).

Emission reductions calculation: Data required for calculating baseline will be fed into a processor (spreadsheet application) which will calculate the emission reductions according to the formulae described above (B.6.1), using the defined default values. Access to the spreadsheet will be controlled for security. The process will include various checks, such as the comparison of the total energy generated by the power units and delivered to the grid, against the energy supplied to the grid as is indicated in the electricity sales receipts or similar documents obtained from the grid´s operator.

Non-essential data: The on-line monitoring system will also record "non-essential" data. Such data is termed non-essential because it is not directly listed in the monitoring methodology, but it will constitute a means of corroborating the on-line system. Non-essential data will include measurements of net and gross output from generator, certificated conversion efficiency, fed water and any other data considered relevant to the project activity.

Accuracy and calibration of the equipment: All meters will be operated and maintained according to the manufacturers' specifications. All key meters will be subjected to a quality control regime that will include maintenance and periodic calibration, as indicated in Resolution CREG 025- Measurement Code[5]. A record will be maintained showing the location and unique identification number of each meter, the calibration status of that meter (date of the last calibration and date of the next calibration) and who will develop the

[5] This regulation indicates that the owner of the measurement equipment is forced to develop a regular maintenance and calibration program.

calibration service. Calibration certificates will be retained for all meters until two years after the end of the crediting period.

Archiving data: The on-line system will archive data automatically in a secure and retrievable storage format on a periodic basis (eg. weekly basis). Calibration log registries will be archived in an accessible electronic format. This data will be stored for at least two years after the crediting period ends.

Document control: A document control system will be implemented to ensure that current versions of the necessary documents are available at the point of use. A CDM monitoring guideline will be adopted to guarantee the best practice and results in the monitoring implementation.

Preparation of the monitoring report: Data filed/measured will be used to prepare a monitoring report to be submitted to the DOE for verification and to the CDM Executive Board for issuance of CERs. A standard format for the monitoring report will be prepared before the presentation of the first monitoring report.

Treatment of lost or damaged data: Where data in the on-line system are corrupted or missing whilst the generator is operating (as shown, for example, by monitoring equipment failure) the missing data can be estimated by taking the lower value for the parameter in question in the hour before the error arose or the hour immediately after the system came on-line again. If there is evidence to suggest that both of these values are un-representative, the average from the previous 24 hours will be used. The error will be recorded in the daily log sheet and the occurrence of the error will be investigated and rectified as soon as possible. If the on-line system is compromised for more than 24 hours, data will be manually recorded. Any deficiencies in energy generated monitoring data will be rectified by back calculation from power sold.

Auditing function and management revision: The plant manager will be responsible for auditing the monitoring management system at least once per year. The auditor will not be involved in the daily operation of the power plant, and if is necessary, may be sourced from a third party. The auditor will evaluate the implementation of the monitoring plan and the preparation of the monitoring report. Audit findings, and steps taken to address findings will be recorded and reviewed in a management review meeting (convened at least annually) at which time the effectiveness of these procedures will be reviewed and necessary changes implemented.

SECTION C. Duration and crediting period

C.1. Duration of bundle

C.1.1. Start date of bundle

The contract No.1-01-26300-1063-2009[6], signed between the contractor Consorcio Generación Bogotá and the project participant, establishes as a starting date the signature of the Work Initiation Act (document signed on 01/03/2010[7]). The project participant decides to use this date as a starting date for the project activity, since this was the moment in which it has acquired contractual obligations to execute expenditures related to the implementation/construction of the power plant (this act indicates that a real action has begun).

C.1.2. Expected operational lifetime of project activities

[6] The document "Contract No.1-01-26300-1063-2009" was signed on 24/12/2009.
[7] Work initiation act signed by the EAAb and the the contractor Consorcio Generación Bogotá.

25 years[8]

C.2. Crediting period of bundle
C.2.1. Type of crediting period

Renewable crediting period

C.2.2. Start date of crediting period

01/03/2013 (or the registration date, whichever is later)

C.2.3. Length of crediting period

7 years

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[8] Communications from "Consorcio Generación Bogotá" certifying the expected lifetime of the main equipment of each power plant (Suba and Usaquen), dated January 8, 2013.

Appendix 1: Contact information of project participants in the bundle

Organization	Empresa de Acueducto y Alcantarillado de Bogotá E.S.P-EAAB
Street/P.O. Box	Avenida Calle 24 No. 37 - 15
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City	Bogotá
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Salutation	Mr
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History of the document

Version	Date	Nature of revision
03.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the CDM small-scale project activities bundling form" (EB 66, Annex 22).
02	EB 23, Annex 26 24 Feb 2006	EB 23, Para 74.
01		Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		