



Monitoring report form (Version 03.1)

Monitoring report

Title of the project activity	Candelaria Hydroelectric Project
Reference number of the project activity	0604
Version number of the monitoring report	1
Completion date of the monitoring report	22/03/2013
Registration date of the project activity	09/11/2006
Monitoring period number and duration of this monitoring period	5 th monitoring period 01/06/2011 to 31/12/12
Project participant(s)	Hidroeléctrica Candelaria, S.A. (Host) Ecoinvest Carbon, S.A. (Other)
Host Party(ies)	Guatemala
Sectoral scope(s) and applied methodology(ies)	Scope 1: Energy industries (renewable- /non-renewable sources) AMS-I.D. Grid Connected renewable electricity generation (version 8)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	32,727 tCO ₂ e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	35,693 tCO ₂ e

SECTION A. Description of project activity**A.1. Purpose and general description of project activity**

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(a) Purpose of the project activity and the measures taken for GHG emission reductions

The objective of the project activity is to generate renewable electricity using hydroelectric resources and to sell the generated output to the national grid. The project has the capacity to reduce CO₂ emissions by avoiding electricity generation by the fossil fuel-fired power plants connected to the grid.

(b) Brief description of the installed technology and equipment

The project has an installed capacity of 4.3 MW and utilizes water from the Trece Aguas River. Currently, this watercourse is also utilized for electricity generation in an existing 16 MW hydropower plant (Secacao) located upstream of Candelaria plant. Secacao plant was developed in 1998 and is owned and operated by Candelaria's sponsors.

Total differential altitude (head) between the head pond and the turbine/generator of Candelaria is approximately 130 meters. The project consists of a 4.3 MW Francis type turbine, a 430 meter long tunnel, a 770 meter long penstock. The water used, once having gone through both plants, is returned to the original river basin downstream.

The plant delivers electricity to the Guatemalan National Electric Grid and is connected to it through a 69 kilovolt transmission line. The plant also delivers part of its output locally through an existing 13.8 kilovolt distribution line owned by a Utility serving this rural area, thus giving access to electricity to several local communities.

(c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)

The construction of Candelaria Hydroelectric Project began in January 2005 and the commissioning took place from 12/06/2006 to 30/06/2006 to successfully start power generation on 01/07/2006. Since 2006, Candelaria Hydroelectric plant has been continuously operating and delivering energy to the National Grid.

(d) Total GHG emission reductions achieved in this monitoring period

Calculation of the emissions reductions are based on validated and registered parameters in the PDD and justified during the validation. The baseline combined margin emission factor for Candelaria Hydroelectric plant is 0.824 tCO₂/MWh.

The total emission reductions achieved in the 5th monitoring period from 01/06/2011 to 31/12/2012 is 35,693 tCO₂e.

A.2. Location of project activity

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Candelaria Hydroelectric plant is located in the north-central area of Guatemala, Senahú, Alta Verapaz Guatemala on the mountain range called "Sierra de Santa Cruz," on the northern side of the Polochic River Valley. The exact geographical coordinates of the power house are: 15.38695 N and -89.75510 W.

Figure 1 shows a map identifying the general location of the project:



Figure 1: Alta Verapaz Department, Guatemala

A.3. Parties and project participant(s)

Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Guatemala (host)	Hidroeléctrica Candelaria, S.A. (private)	No
Switzerland (other)	Ecoinvest Carbon, S.A. (private)	No

A.4. Reference of applied methodology

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“AMS-I.D. Grid connected renewable electricity generation” (version 8).

For more information regarding the methodology, please refer to the following link:

<http://cdm.unfccc.int/methodologies/DB/RSC TZ8SKT4F7N1CFDXCSA7BDQ7FU1X>

A.5. Crediting period of project activity

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Type: Renewable crediting period (7 years x 3)

Starting date: 01/01/2007

Length: 7 years

Crediting period: 01/01/2007 to 31/12/2013

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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Candelaria Hydroelectric Project has an installed capacity of 4.3 MW and 130 meters of net head utilizing water from the Trece Aguas River. The water flows through a tailrace channel from where it enters into a 430 meter long tunnel. The water then runs through a head pond and into a 770 meters long penstock, and finally propels in a 4.3 MW Francis type turbine located at Candelaria power house. The water used is returned to the original river basin downstream.

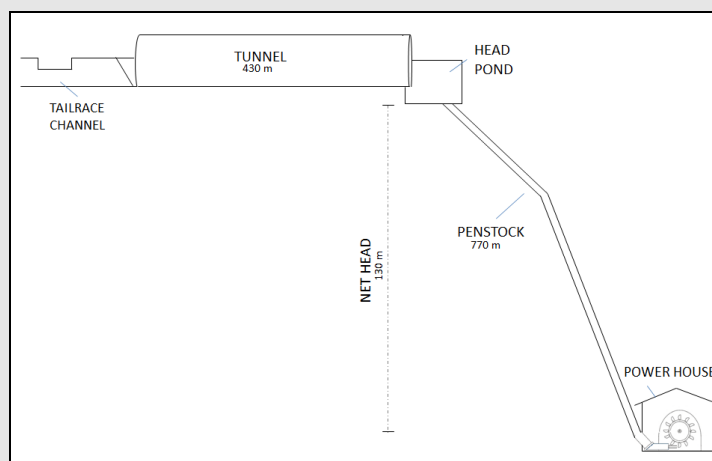


Figure 2 Candelaria's outline

The plant delivers electricity to the Guatemalan National Electric Grid and it is connected to a 69 kilovolt transmission line. The plant also delivers part of its output locally through an existing 13.8 kilovolt distribution line, giving access to electricity to several local communities.

Every year the operations management executes the annual programmed maintenance between April or May. On 2012, the annual programmed maintenance started on April 18 and finished on April 29. No overhaul, down of equipment or exchange of equipment was made on this maintenance nor during this monitoring report period.

No equipment has changed since Candelaria Hydroelectric Project began operations on 2006 and the plant continues operating with the same equipment since its beginning.

B.2. Post registration changes

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

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Not applicable.

B.2.2. Corrections

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Not applicable.

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

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Not applicable.

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

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Not applicable.

B.2.5. Changes to start date of crediting period

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Not applicable.

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

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Not applicable.

SECTION C. Description of monitoring system

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- Equipment used for the commercial measuring**

The equipment used to measure the energy produced by the Candelaria Hydroelectric Plant consists in a main and a backup meter (electronic General Electric meters). This is in line with the stipulations described in the Commercial Coordination Norm, No. 14, (NCC-14) issued by the Wholesale Market Administrator (*Administrador del Mercado Mayorista - AMM*)¹, clauses 14.6.1, 14.10 bis and 14.10 tris.

Candelaria's Main Meter Features	Candelaria's Support Meter Features
<ul style="list-style-type: none"> Model: KV2c Brand: General Electric Serial number: 28 620 847 	<ul style="list-style-type: none"> Model: KV2c Brand: General Electric Serial number: 28 620 848

The metering units are shown in the following diagram:

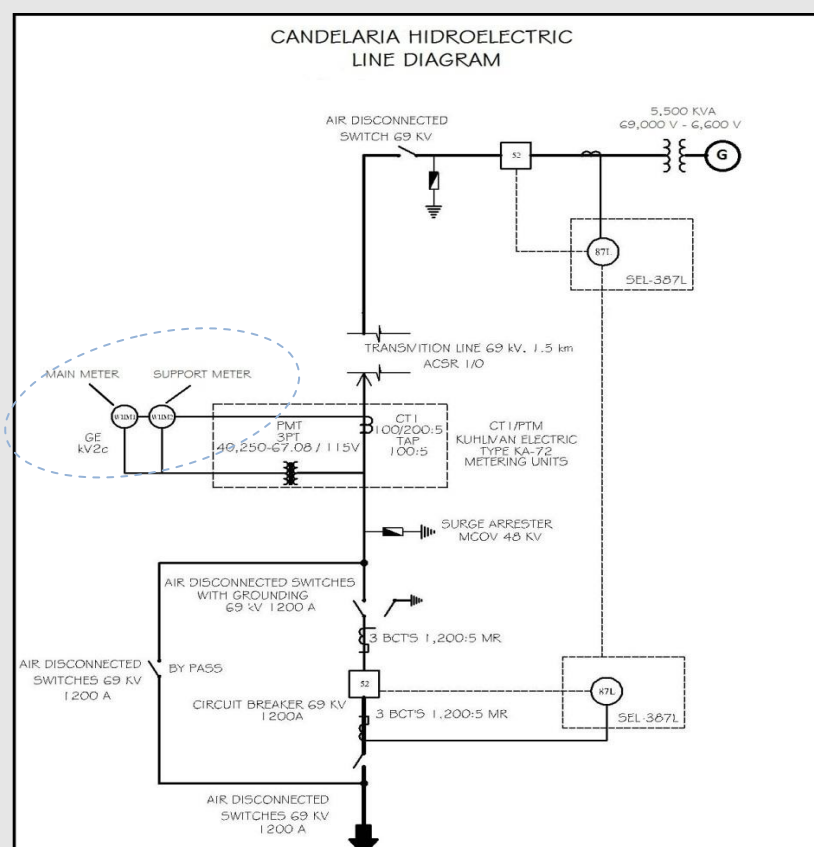


Figure 3: Candelaria Hydroelectric Line Diagram

¹ The Wholesale Market Administrator (Administrador del Mercado Mayorista) is the entity in charge of dispatching and programming the operation and coordination of the National Power Grid.

- **Data quality obtained from the energy meters**

The Candelaria Hydroelectric Project satisfies the conditions set forth in the Commercial Coordination Norm number 14 (NCC-14), clause 14.12, which stipulates that the producer agent shall verify and calibrate its commercial meters at least once a year to guarantee the precision and quality required.

In compliance with the aforementioned norm, both commercial meters used in the Candelaria Hydroelectric Project are calibrated annually by AMELEC, the company authorized and certified by AMM to calibrate commercial meters.

- **Data collection procedures**

The energy data of the Candelaria Hydroelectric Project are captured and recorded by three different procedures. Each procedure and the data collected are also verified by different persons to ensure the accuracy of the measured data. The procedures used to collect, monitor and register the data of the produced energy are described below:

1. Hourly and Daily Readings Procedure

Source of data:	SCADA system / Main and Support commercial meters
Responsible to collect data:	Operator
Responsible of quality data:	Operations Supervisor

Procedure:

The SCADA system reports hourly the instantaneous power and other generation conditions. This system works using a computer with SCADA (Supervisory Control and Data Acquisition) software, connected to a PLC (Programmable Logic Controller) device that automatically captures the information and converts it to data. This hourly generation data is available to the operator continuously 24 hours a day on the computer screen. The Operator is responsible for transcribing the hourly data to the "Operation Control Sheets", which are kept in the Control Room of the plant.

Besides this, at 00:00hrs, the Operator directly takes visual meter readings (from the main commercial meter). The difference from the previous day's reading and the current reading corresponds to the energy produced over that day (data read in kilowatts).

In addition, an internal daily report is made by an automatic Data Monitoring System (Sistema de Monitoreo de Información –SIMON-), which is fed by the Operator with the SCADA and the commercial meter data. This program allows the access to updated data and graphics of the daily, weekly, monthly and yearly power and energy produced by Candelaria Hydroelectric Plant.

2. Monthly Readings Procedure

Source of data:	Main and Support commercial meters
Responsible to collect data:	Operations Supervisor
Responsible of quality data:	Operations Manager

Procedure:

Once a month, the Operations Supervisor uses the automated reading system to summarize, for billing purposes, the total energy produced by Candelaria Hydroelectric Plant. On the first day of the month, the Operations Supervisor uses an optical reader connected to a portable computer in which the Meter Mate Software (meter-reading software provided by General Electric) has been installed. This software allows for hourly automatic reading: the optical reader is positioned on the meter control panel lens and an hhf format file with all the updated hourly energy production reading is automatically created. Both hhf format files are sent by email to the Operations Manager, who exports it to an Excel file, reviews it and generates a monthly report, allowing the total calculation of generated energy. Both reports are sent to the Financial Manager, General Manager Assistant, Comercializadora *Electronova*'s Market Manager and to the AMM's Measuring Coordinator, for their revision or reference.

Both entities (*AMM* and *Electronova*) compare the measurements taken by Candelaria Hydroelectric plant with those taken through the external meters owned by the Wholesale Market Administrator. Once *AMM* and *Comercializadora Electronova* confirm their approval of the report, commercial invoice is issued by

Candelaria Hydroelectric plant for the energy provided to the national grid.

3. Yearly Data Collection Procedure

Source of data: Monthly commercial invoice reports
 Responsible to collect data: Financial Manager
 Responsible of quality data: General Manager

In order to prepare the monitoring report to calculate the total energy produced by the Candelaria Hydroelectric Plant and estimate the certified reduced emissions, the General Management and Financial Division collect in a single report all the monthly reports used for billing purposes in an Excel spreadsheet, calculating the annual emission reductions. This report is reviewed and approved by the General Manager.

SECTION D. Data and parameters

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

(Copy this table for each piece of data and parameter.)

Data / Parameter:	(E)baseline
Unit:	tCO₂/MWh
Description:	Combined Margin Emission Factor
Source of data:	Ex ante calculated according to the registered PDD
Value(s) applied:	0.824
Purpose of data:	(a) Calculation of baseline emissions
Additional comment:	

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter:	CG
Unit:	MWh
Description:	Electricity generation of the Candelaria hydropower plant
Measured/ Calculated / Default:	Measured
Source of data:	Commercial Meters
Value(s) of monitored parameter:	Hourly readings from 01/06/2011 to 31/12/2012. Details are shown in Excel spreadsheet titled " <i>Energy data and CERs Calculations – 5th Monitoring Period</i> " attached to this Monitoring Report
Monitoring equipment:	Commercial Electricity Main Meter Model: KV2c Brand: General Electric Serial number: 28 620 847 Accuracy: 0.2% according to regulation Dates of calibration: 02/05/2011 and 24/04/2012 Validity: 1 year Commercial Electricity Support Meter Model: KV2c Brand: General Electric Serial number: 28 620 848 Accuracy: 0.2% according to regulation Dates of calibration: 02/05/2011 and 24/04/2012 Validity: 1 year

Measuring/ Reading/ Recording frequency:	Measuring: Hourly continued Recording: Hourly, Daily, Monthly and Yearly
Calculation method (if applicable):	-
QA/QC procedures:	According to the Commercial Coordination Norm No. 14 (NCC-14), clause 14.12, "Periodic Verifications", issued by the Wholesale Market Administrator, meters will be calibrated yearly. Data measured by the meters will be cross checked with the Buyer's electricity reports, monthly invoices, and through the records saved in the SCADA system, (software used by the Wholesale Market Administrator to control and measure all the electricity delivered to the national grid).
Purpose of data:	(a) Calculation of baseline emissions
Additional comment:	

D.3. Implementation of sampling plan

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Not applicable.

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

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

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Baseline emissions are calculated in accordance with the AMS-I.D (version 8) and the registered PDD according to the following equation:

$$E_{\text{baseline}} \text{ (tonnes CO}_2\text{/year)} = \langle E \rangle_{\text{baseline}} \text{ (tonnes CO}_2\text{/MWh)} \times CG \text{ (MWh/year)} \quad (1)$$

Where:

E_{baseline} = Baseline emissions
 $\langle E \rangle_{\text{baseline}}$ = Combined margin emission factor
 CG = Candelaria's electricity generation

As per the registered PDD, the ex-ante calculation of the combined emission factor of **0.824 tCO₂/MWh** resulted from a build margin of 0.880 tCO₂/MWh and an operating margin of 0.767 tCO₂/MWh. This value is considered fixed throughout the first crediting period.

The electricity generated by Candelaria during the 5th Monitoring Period is summarized in the next table. A complete report of the delivered electricity is shown in the attached "*Energy data and CERs Calculation – 5th Monitoring Report*" spreadsheet.

**Candelaria Hydroelectric Plant
Monthly Generation**

Period: June 2011 to December 2012, 5th Monitoring Period

Year	Month	MW/hour
2011	June	1,762.598
	July	2,868.229
	August	2,596.779
	September	2,910.937
	October	2,924.410
	November	2,729.606
	December	2,105.098
2012	January	1,915.284
	February	1,700.761
	March	1,431.480
	April	781.274
	May	1,377.960
	Jun	2,001.332
	Jul	2,697.635
	Ago	3,076.198
	Sep	3,031.447
	Oct	3,075.674
	Nov	2,398.398
	Dic	1,932.586
TOTAL		43,317.685

Table 1: Candelaria's Monthly Generation

The emission reductions calculated for the 5th Monitoring Period are as follows:

Parameter	$\langle E \rangle_{baseline}$ (tCO ₂ /MWh)	CG (MWh/year)	$E_{baseline}$ (tCO ₂ /year)
Data	0.824	43,317.685	35,693

Table 2: Baseline emission reductions of the project activity

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

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According to AMS-I.D (version 8) and the registered PDD, project emissions are considered zero, i.e. $PE = 0$.

E.3. Calculation of leakage

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According to AMS-I.D (version 8) and the registered PDD, project leakages are considered zero.

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

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	35,693	0	0	35,693

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

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO₂e)	32,727	35,693

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

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Hydrological conditions were not as expected, resulting this in more generation than the estimated.

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

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Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO₂e)	Not applicable.	Not applicable.

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Document information

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

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