



Monitoring report form
(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT

Title of the project activity	Candelaria Hydroelectric Project	
UNFCCC reference number of the project activity	0604	
Version number of the monitoring report	1	
Completion date of the monitoring report	29/03/2016	
Monitoring period number and duration of this monitoring period	6 th monitoring period 01/01/2013 to 31/12/2013 (12 months)	
Project participant(s)	Hidroeléctrica Candelaria, S.A.(Host)	
Host Party	Guatemala	
Sectoral scope(s)	Scope 1: Energy industries (renewable-/non-renewable sources)	
Selected methodology(ies)	AMS-I.D. Grid Connected renewable electricity generation (version 8)	
Selected standardized baseline(s)	N/A	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	18,922 tCO ₂ e	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	0	21,831 tCO ₂ e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

(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 MW¹ 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 4.456 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 has the capacity to deliver part of its output locally, when required, 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

The 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 6th monitoring period from 01/01/2013 to 31/12/2013 is 21,831 tCO₂e.

¹ The installed capacity of the hydroelectric plant is determined and delimited by the capacity of the generator. As indicated by the manufacturer of the generator of Candelaria, the generator has an apparent power of 5,397 kVA and a power factor of 0.8. The maximum output capacity of the generator is the real power (in kW) and results from multiplying the apparent power (in kVA) by the power factor, as follows: 5,397 kVA × 0.8 = 4,318 kW = 4.3 MW

A.2. Location of project activity

The 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 whether the Party involved wishes to be considered as project participant (yes/no)
Guatemala (host)	Hidroeléctrica Candelaria, S.A. (private)	No

A.4. Reference of applied methodology and standardized baseline

“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/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X>

A.5. Crediting period of project activity

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

A.6. Contact information of responsible persons/entities

Hidroeléctrica Candelaria, S.A. (project participant)

info@gruposecacao.com

16 Calle 0-26, Zona 14, Ciudad de Guatemala, Guatemala

+502 2313 8383

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The 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 4.456 MW Francis type turbine located at Candelaria's power house. The water used is returned to the original river basin downstream.

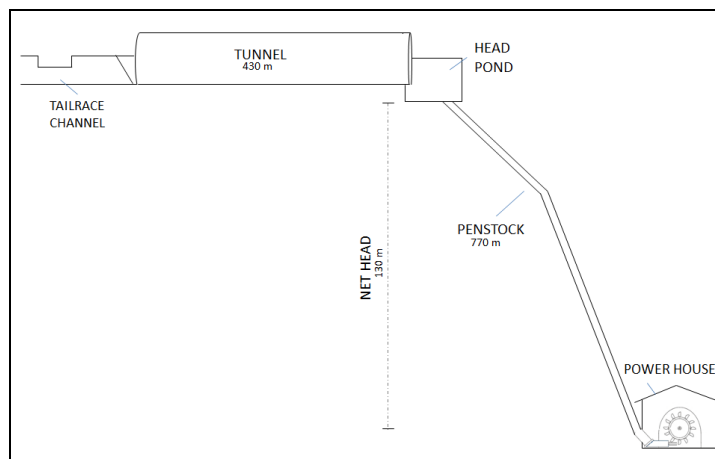


Figure 2 Candelaria's outline

The plant delivers electricity to the Guatemalan National Electric Grid and it is connected to a 69 kilovolt transmission line. The plant has also the capacity to deliver, when required, 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 and May. On 2013, the annual programmed maintenance started on April 23 and finished on May 06. No 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, applied methodology or applied standardized baseline

Not applicable.

B.2.2. Corrections

Not applicable.

B.2.3. Changes to start date of crediting period

Not applicable.

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

Not applicable.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

Not applicable.

B.2.6. Changes to project design of registered project activity

Approval date: 28 Mar 14

Reference number: PRC-0604-001

B.2.7. Types of changes specific to afforestation or reforestation project activity

Not applicable.

SECTION C. Description of monitoring system

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)², 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:

² 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.

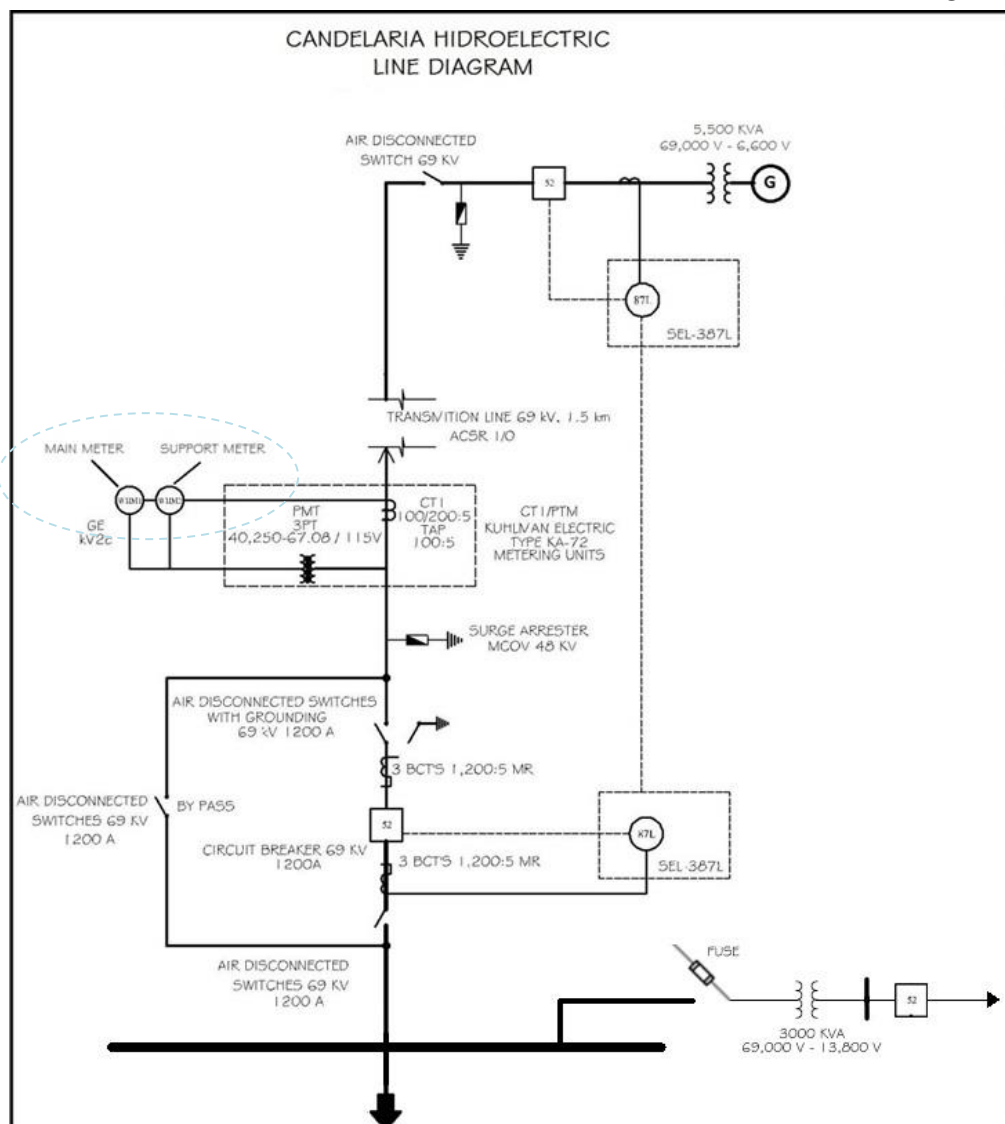


Figure 3 Candelaria Hydroelectric Line Diagram

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

As set forth, by the Wholesale Market Administrator, in the Commercial Coordination Norm number 14 (NCC-14), clause 14.12, the Wholesale Market Administrator is in charge of verifying the commercial meters and associated installations of the producer agent at least once a year, in order to guarantee the precision and quality required. If the results of the verification show inaccuracy and imprecision in the energy measurement, then the producer agent will be notified and a corrective action (defined in the NCC-14) should be taken. (Verification's results are notified to the producer agent just in those cases when an accuracy and precision problem is detected.)

Additionally, as an internal quality control procedure, in order to guarantee the precision and quality required, a verification of the calibration of both commercial meters used in Candelaria Hydroelectric Project is executed annually, by the company AMELEC.

- **Data collection and monitoring procedures**

The energy data of the Candelaria Hydroelectric Project are monitored, 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.

These procedures are performed for monitoring purposes.

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	tCO ₂ /MWh
Description	Combined Margin Emission Factor
Source of data	Ex ante calculated according to the registered PDD
Value(s) applied)	0.824
Choice of data or measurement methods and procedures	NA
Purpose of data	(a) Calculation of baseline emissions
Additional comments	-

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 01/01/2013 to 31/12/2013. Details are shown in Excel spreadsheet titled " <i>Energy data and CERs Calculations – 6th 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: 24/04/2012 and 24/04/2013 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: 24/04/2012 and 24/04/2013 Validity: 1 year
Measuring/reading/recording frequency:	Measuring: Hourly continued Recording: Each 15 minutes, Hourly, Daily, Monthly and Yearly
Calculation method (if applicable):	NA

QA/QC procedures:	According to the Commercial Coordination Norm No. 14 (NCC-14), clause 14.12, "Periodic Verifications", issued by the Wholesale Market Administrator, the calibration of meters will be verified yearly. Data measured by the meters is cross checked with the Buyer's electricity reports 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 comments:	-

D.3. Implementation of sampling plan

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

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

$$E_{baseline} \text{ (tonnes } CO_2/\text{year)} = \langle E \rangle_{baseline} \text{ (tonnes } CO_2/MWh) \times CG \text{ (MWh/year)} \quad (1)$$

Where:

$E_{baseline}$ = Baseline emissions
 $\langle E \rangle_{baseline}$ = 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 net electricity delivered to the grid, generated by Candelaria during the 6th 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 – 6th Monitoring Report*" spreadsheet.

Candelaria Hydroelectric Plant
Monthly Net Electricity Delivered to the Grid

Period: January 2013 to December 2013, 6th Monitoring Period

Year	Month	MWhour
2013	January	1,685
	February	1,279
	March	1,218
	April	777
	May	1,110
	Jun	2,455
	Jul	3,050
	Ago	3,155
	Sep	3,052
	Oct	3,067
	Nov	3,091
	Dic	2,555
TOTAL		26,494

Table 1: Candelaria's Monthly Generation

The emission reductions calculated for the 6th Monitoring Period are as follows:

Parameter	$\langle E \rangle_{baseline}$ (t CO ₂ /MWh)	CG (MWh/year)	$E_{baseline}$ (t CO ₂ /year)
Data	0.824	26,494	21,831

Table 2: Baseline emission reductions of the project activity

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

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

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 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)	GHG emission reductions or net GHG removals by sinks (t CO ₂ e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	21,831	0	0	0	21,831	21,831

E.5. Comparison of actual emission reductions or net 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 CO ₂ e)	18,922 tCO ₂ e	21,831 tCO ₂ e

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

The significant increase in rainfall during 2013 caused a flow growth of many rivers of the region, including the Trece Aguas River. This, automatically results in the increase of emission reductions generated during this monitoring period.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	<input checked="" type="checkbox"/> Project participant <input checked="" type="checkbox"/> Person/entity responsible for completing the CDM-MR-FORM
Organization name	Hidroeléctrica Candelaria, S.A.
Street/P.O. Box	16 Calle
Building	0-26
City	Zona 14, Guatemala
State/region	Guatemala
Postcode	01014
Country	Guatemala
Telephone	+502 2313 8383
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Contact person	Rodrigo Tormo
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Personal e-mail	

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
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 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.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		