Monitoring report form for CDM project activity
(Version 08.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT			
Title of the project activity	Choloma Hydroelectric Project		
UNFCCC reference number of the project activity	9306		
Version number of the PDD applicable to this monitoring report	3.4		
Version number of this monitoring report	1		
Completion date of this monitoring report	7/06/2021		
Monitoring period number	3rd monitoring period of the 1st Crediting Period		
Duration of this monitoring period	01/01/2019 to 31/12/2019 12 months		
Monitoring report number for this monitoring period	N/A		
Project participants	Hidroeléctrica Choloma, S.A.		
Host Party	Guatemala		
Applied methodologies and standardized baselines	AMS-ID: Grid connected renewable electricity generation, version 17.0		
Sectoral scopes	Sectoral scope: 1. Energy industries (renewable- / non-renewable sources)		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	0	8,694	0
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	18,926 tCO_2e		

SECTION A. Description of project activity

A.1. General description of project activity

- **Purpose of the project activity and the measures taken for GHG emission reductions**

The purpose of the proposed project activity is to generate electricity using renewable hydrological resources and to deliver the generated output to the national grid. The electricity produced contributes to meet the electricity demand and reduces CO_2 emissions by avoiding electricity generation by fossil fuel-fired power plants connected to the grid.

- **Brief description of the installed technology and equipment**

The project activity consists of a small-scale hydroelectric plant with an installed capacity of 9.7 MW[1]. It has a gross head of 461 meters, and a design flow of 2.5 cubic meters per second. The powerhouse is equipped with a 9.577 MW turbine and a 9.7 MW generator.

Further information about this project can be found in the PDD and documents associated, which are available on UNFCCC website:
https://cdm.unfccc.int/Projects/DB/AENOR1356628448.64/view?cp=1

- **Total GHG emission reductions achieved in this monitoring period**

The calculation of the emissions reductions is based on the validated and registered PDD, and the parameters specified in the monitoring plan.

The total emission reductions achieved during the 3rd monitoring period from 01/01/2019 to 31/12/2019 is 8,694 tCO_2e.

A.2. Location of project activity

The Cholomá Hydroelectric plant is in the north-central area of Guatemala. The project is located on the Choloma River, in the Department (State) of Alta Verapaz, Municipality of Senahú around 200 kilometres North-east of Guatemala City.

The geographical coordinates are: 15.41656531, -89.74165110

[1] As indicated by the manufacturer in the nameplate of the electrical generator.

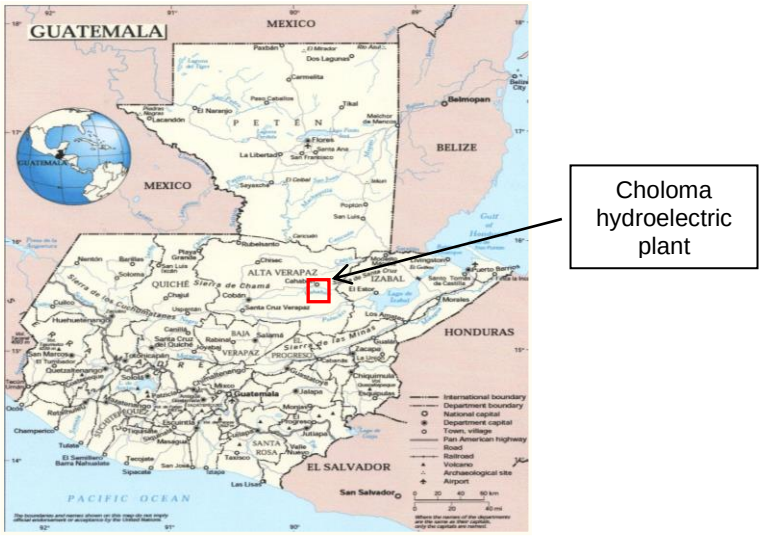

Figure 1. Choloma Hydroelectric Project location

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Guatemala (host)	Hidroeléctrica Choloma, S.A. (private)	No

A.4. References to applied methodologies and standardized baselines

The project activity does not use a standardized baseline.

(a) Emission reductions were calculated in accordance with the Monitoring Plan established as per approved methodology: *AMS-I.D. Grid connected renewable electricity generation*, version 17.0. (http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X) and "Tool to calculate the emission factor for an electricity system", version 7.0.

(b) Emission reductions were calculated in accordance with the Monitoring Plan established as per approved methodology: *AMS-I.D. Grid connected renewable electricity generation*, version 17.0. (http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X) and "Tool to calculate the emission factor for an electricity system", version 04.0.

(c) *Guidelines on the Demonstration of Additionality of Small-Scale Project Activities* (EB 68 Annex 27) were applied when the project activity was registered. https://cdm.unfccc.int/Reference/Guidclarif/meth/methSSC_guid05.pdf

(d) Methodological tool 09 on *Determining the baseline efficiency of thermal or electric energy generation systems* was used as reference for the Default efficiency factors of power units. https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v2.0.pdf

A.5. Crediting period type and duration

Type: Renewable crediting period (7 years x 3)
Starting date: 01/01/2013
Length: 7 years
Crediting period: 01/01/2013 to 31/12/2019

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

- **Description of the installed technologies, technical processes, and equipment**

The Choloma Hydroelectric Project, that started commercial operations in November 2011, was designed as a peaking or daily regulation plant. It includes a small artificial reservoir (water storage tank) with a capacity of 20,000 cubic meters of live storage volume that allows water storage during daily low demand hours, which is then released during daily peak demand hours.

Water from the Choloma River and its tributaries is conducted to the water storage tank through the low-pressure system. It consists in small water diversion dams built at each of the tributaries and the Choloma river, and the low-pressure buried pipes that lead the water to the storage tank.

The Choloma Hydroelectric Project has a gross head of 461 meters, and a design flow of 2.5 cubic meters per second. The powerhouse is equipped with a 9.577 MW turbine, and a 9.7 MW generator. The water used is returned to the original river basin downstream.

Outside of the powerhouse an electrical switchyard is installed. It contains the main step-up transporter and related switchgear. A 4-kilometer long 69-kilovolt-transmission line connects the Choloma substation with the Secacao substation, from where the net electricity produced by the project is delivered to the Guatemalan transmission grid. The electricity metering equipment is installed at the Secacao substation.

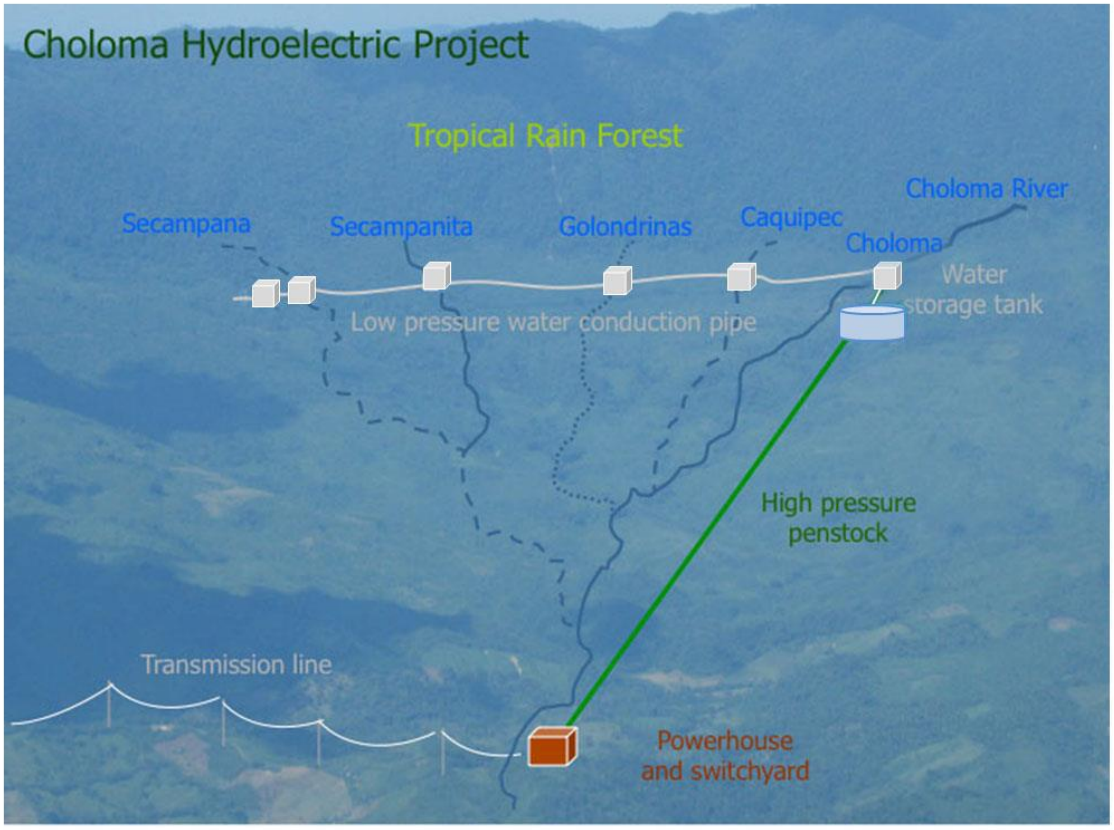

Figure 2. Choloma's layout

No electric generation equipment has changed since Choloma Hydroelectric Project began operations in 2011. The plant continues operating with the same electric generation equipment as indicated in the registered PDD.

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

The construction of Choloma Hydroelectric Project began constructions on 24 June 2010 and the commissioning took place in November and December 2011, to successfully start commercial operations on 11 December 2011.

The Project was registered under the Clean Development Mechanism on 28 December 2012, starting its first crediting period on 1 January 2013.

Starting date of the project activity is fixed by the date when the contract for "Supply, Start-up and Testing of Turbine, Generator, Controls and Associated Equipment" with Gilbert Gilkes & Gordon Ltd. (Gilkes) was signed.

Every year, the Operations Management executes the annual programmed maintenance between March and May. On 2019, the annual programmed maintenance started on March 27 and finished on April 1st.

During this monitoring period, no event occurred that could have affected the monitored data and parameters.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

Not applicable.

B.2.2. Corrections

Not applicable.

B.2.3. Changes to the start date of the crediting period

The starting date of the crediting period indicated in the registered PDD was changed and approved by the Executive Board from 01/03/13 – 29/02/2020 to 01/01/2013 -31/12/2019.

B.2.4. Inclusion of monitoring plan

Not applicable.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

Not applicable.

B.2.6. Changes to project design

Not applicable.

B.2.7. Changes specific to afforestation or reforestation project activity

Not applicable.

SECTION C. Description of monitoring system

The monitoring plan comprises the compilation and filling of all relevant data needed to estimate the emissions reductions by the CDM project activity. Its objective is to assure the complete, consistent, clear, and accurate monitoring and calculation of emissions reductions within the project activity boundaries, during this monitoring period; according to version 17 of the 'Simplified baseline methodologies for selected small-scale CDM project activity'.

Data and parameters monitored are the following:

Data / Parameter:	Description:	Measured/ Calculated /Default	Purpose:
$EG_{facility,y}$	Quantity of net electricity supplied to the grid in year y	Measured	Calculation of baseline emissions
Cap_{PJ}	Installed capacity of the hydro power plant after the implementation of the project activity	Default (verified)	Assurance that power density is greater than 10 W/m^2
A_{PJ}	Area of the multiple reservoirs measured in the surface of the water, after the implementation of the	Default (checked)	Assurance that power density is greater than 10 W/m^2

	project activity, when the reservoir is full (m^2)		
$EF_{CO2,y}$	CO_2 emission factor of the grid electricity in year *y*	Calculated	Calculation of the baseline emissions
$EG_{m,y}$ and $EG_{k,y}$	Net electricity generated by power plant/unit in year *y*	Default	Calculation of the CO_2 emission factor of the grid in year *y*
$EF_{CO2,m,i,y}$	CO_2 emissions factor of fuel type *i,* used in generating units *m and k*	Default	Calculation of the CO_2 emission factor of the grid in year *y*
$\eta_{m,y}$ *and* $\eta_{k,y}$	Average net energy conversion efficiency of power unit m or k in year y	Default	Calculation of the CO_2 emission factor of the grid in year *y*

Next figure shows the location of the monitoring points of data and parameters monitored within the project activity boundaries:

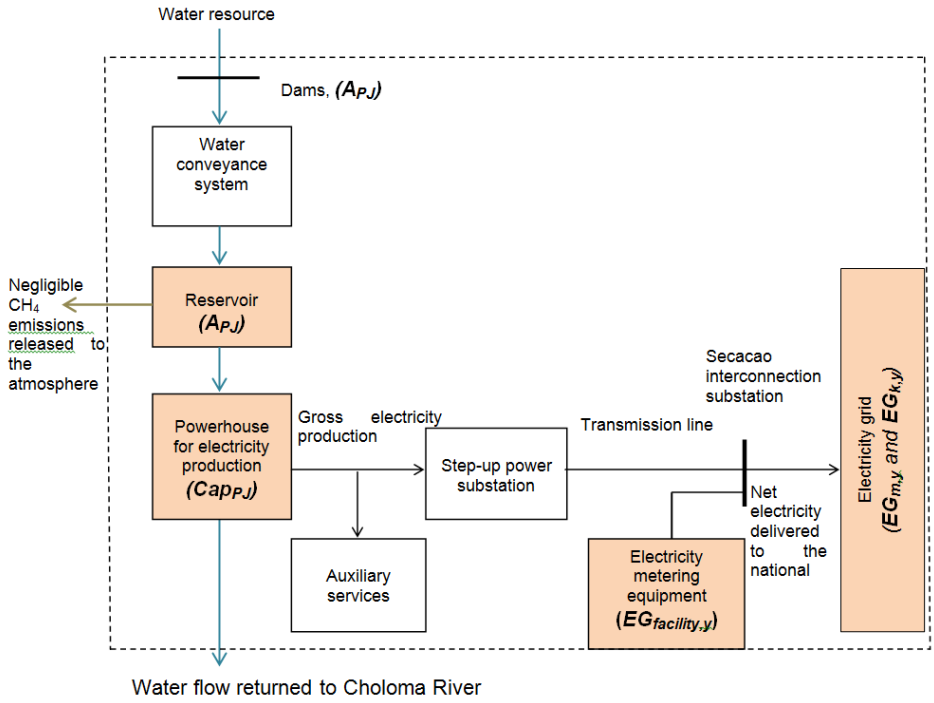

Figure 3. Location of monitoring points

Responsible personnel

The following table describes the responsibilities assigned to the personnel in charge of the monitoring process.

Personnel	Responsibilities
General Manager	• Responsibility of the monitoring plan • Authorization to submit monitoring plans to DOE • Authorization to contract CDM consultants for training, validation and verification activities • Assignment of the personnel in charge of quality control and internal audits • DOE and consultants contracting • Review of CDM process • Revision of monitoring reports
CDM coordinator	• CDM process coordination: assessment of CDM training requirements, planning of CDM training activities, coordination of meetings to revise process, etc. • Revision and verification of monitoring parameters data

	• Calculation of baseline emissions, project activity emissions and emission reductions • Formulation of monitoring reports • Documentation of monitoring processes for verification audits • Data storing in hard and electronic
Plant chief / Operations Manager	• Parameters monitoring in power plant site • Data registration and validation • Assignment of monitoring activities to plant personnel
Commercial analyst (Financial Manager)	• Review (cross-checking) of data from electricity meters against the commercial data

- **Data collection and monitoring procedures**

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

Each process is fed by an input and consists of a series of activities that produce a result or output. The following chart illustrates how the monitoring processes are interrelated:

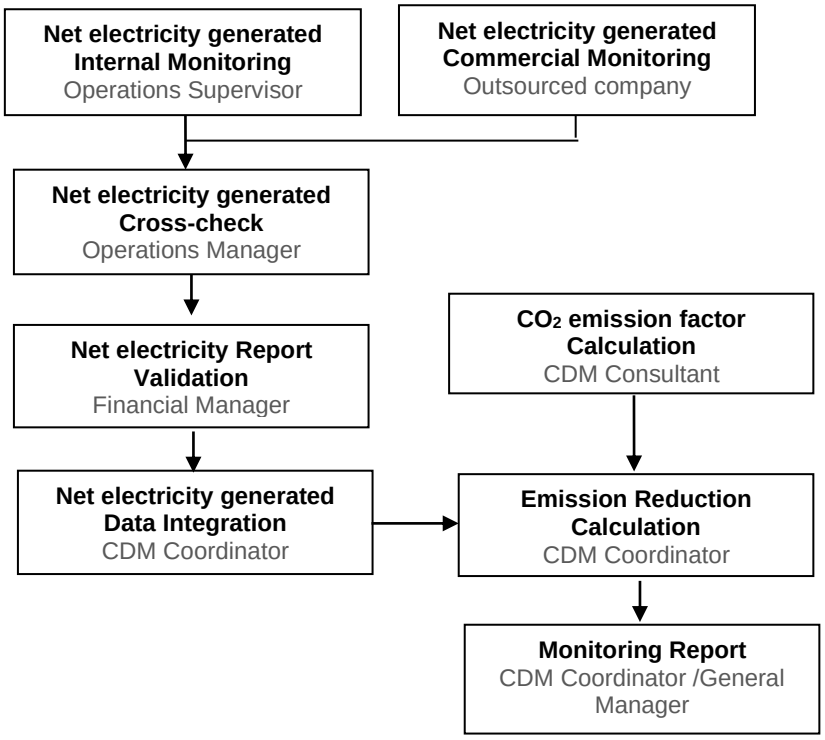

Figure 4. Monitoring System Process

1. **Monthly Readings Procedure for Commercial Monitoring Purposes and Emission Reduction Calculation**

Source of data: Main and Support commercial meters
Responsible of quality data: Operations Manager
Purpose of collected data: Energy sales

Procedure:
On the first days of every month, for billing purposes, the Operations Manager gets the hourly reading and quarterly hours monthly report from Enérgica[2], for his review and validation. The Operation Manager crosscheck the data from Enérgica against the data from the internal monitoring process. This report allows the calculation of that month generated energy.

The validated report is sent to the Financial Manager, General Manager Assistant, Choloma's Client, and AMM's Measuring Coordinator, for their revision and reference. Commercial invoice is issued by Cholomá Hydroelectric plant for the energy provided to the national grid, based on the monthly validated report.

For commercial monitoring purposes, the AMM also has remote access to the main and support meters.

2. Hourly and Daily Readings Procedure for Internal Monitoring Purposes

Source of data: SCADA system / Main and Support commercial meters
Responsible of quality data: Operations Supervisor
Purpose of collected data: Internal control

Procedure:
SCADA system reports permanently 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 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 takes directly 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.
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 Cholomá Hydroelectric Plant.

3. Yearly Data Collection Procedure

Source of data: Monthly commercial invoice reports
Responsible of quality data: CDM Coordinator
Purpose of collected data: Baseline emissions calculation

Procedure:
In order to prepare the monitoring report to calculate the total energy produced by the Cholomá Hydroelectric Plant and estimate the baseline emission reductions, the Financial Division and CDM Division collect in a single report all the monthly reports used for billing purposes in an Excel

[2] Company that provides Cholomá Hydroelectric the service of remote main meter lectures on real time.

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

There are not parameters fixed ex ante.

D.2. Data and parameters monitored

<table>
<tr><td>Data/Parameter</td><td>EG_{facility,y}</td></tr>
<tr><td>Unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Quantity of net electricity supplied to the grid in year y.</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Electricity meters</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><td>Year</td><td>EG_{facility,y}</td></tr>
<tr><td>2019</td><td>20,033 MWh</td></tr>
</table>
Hourly readings from 01/01/2019 to 31/12/2019 and their integration are shown in Excel spreadsheet titled ‘Energy data and CERs calculations – 3rd MP – 1st CP’.
</td></tr>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td></td><td>Main meter</td><td>Back-up meter</td></tr>
<tr><td>Model</td><td>ION8650</td><td>ION8650</td></tr>
<tr><td>Manufacturer</td><td>Power Logic (Schneider Electric)</td><td>Power Logic (Schneider Electric)</td></tr>
<tr><td>Commercial serial number</td><td>F-76199</td><td>F-76200</td></tr>
<tr><td>Manufacturer serial number</td><td>MW-1610A789-02</td><td>MW-1610A790-02</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Data monitored continuously, measured hourly and daily, and recorded hourly, daily, monthly and yearly.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures</td><td>

A quality management system was implemented and procedures are followed for the monitoring, measuring, and recording of the net electricity delivered to the grid.
A cross-check procedure is followed, in which the monitored data is compared monthly with the commercial data (electricity invoices or AMM´s Monthly Transactions Report), and the monitored data is compared with the data registered manually by the plant operator.
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 is notified, and a corrective action (defined in the NCC-14) should be taken. 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 Choloma Hydroelectric Project is executed periodically, by a metrology lab.

</td></tr>
</table>

Purpose of data/parameter	Data used to calculate baseline emissions
Additional comments	To guarantee the precision and quality required, verifications of the calibration of both commercial meters used in the Choloma Hydroelectric Project were performed on January 17, 2019 by the meteorology lab METRIC. The calibration process was executed according to the COGUANOR NGR/ISO/IEC 17025 – 2005 national standard and the ANSI C12-20-2015 (American National Standard for Electricity Meters 0.1, 0.2 and D.5 Accuracy Classes). For the emission reduction calculation, period not covered by the one-year validity calibration were adjusted with a correction factor (0.2%) for conservative purposes.

Data/Parameter	Cap_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Measured/calculated/ default	Default
Source of data	Generator nameplate
Value(s) of monitored parameter	9.7 X 106
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Not applicable.
QA/QC procedures	A control data sheet of a visual verification of the generator nameplate on site is completed and followed.
Purpose of data/parameter	The installed capacity will be checked in order to assure that the power density is greater than 10 W/m^2.
Additional comments	Not applicable.

Data/Parameter	A_{PJ}
Unit	m^2
Description	Area of the multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).
Measured/calculated/ default	Default
Source of data	Power plant site
Value(s) of monitored parameter	<table><tr><th>Reservoir</th><th>Area of the reservoir</th></tr><tr><td>Secampana I diversion dam</td><td>137.21 m^2</td></tr><tr><td>Secampana II diversion dam</td><td>145.01 m^2</td></tr><tr><td>Secampanita diversion dam</td><td>85.95 m^2</td></tr><tr><td>Caquipec diversion dam</td><td>43.93 m^2</td></tr><tr><td>Golondrinas diversion dam</td><td>115.2 m^2</td></tr><tr><td>Choloma diversion dam</td><td>397.23 m^2</td></tr><tr><td>Reservoir-tank</td><td>2,827.44 m^2</td></tr><tr><td>Total area</td><td>3,751.97 m^2</td></tr></table>
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Annually

Calculation method (if applicable)	Not applicable.
QA/QC procedures	A control data sheet is completed and followed, checking of design maps with level curves and borders of each reservoir and verifying that the structures of dams and dimensions of tank have not changed.
Purpose of data/parameter	The surface area of the reservoirs will be checked in order to assure that the power density is greater than 10 W/m^2.
Additional comments	Not applicable.

Data/Parameter	$EF_{CO2,y}$
Unit	t CO_2e/MWh
Description	CO_2 emission factor of the grid electricity in year *y*
Measured/calculated/ default	Calculated
Source of data	• Electricity generation data per power plant and demand curve: AMM´s reports, www.amm.org. • Default values for emission factors of fossil fuels: IPCC Guidelines 2006 • Default efficiencies values for power plant/unit: 'Tool to calculate the emission factor for an electricity system'.
Value(s) of monitored parameter	Year: 2019 — $EF_{CO2,y}$: 0.434 Details of the calculation are shown is Excel spreadsheets titled *'2019 EF Calculation Choloma 2nd crediting period'*
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Annual calculation of the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system'.
QA/QC procedures	Use of official data sources.
Purpose of data/parameter	Calculation of the baseline emissions.
Additional comments	Not applicable.

Data/Parameter	$EG_{m,y}$ *and* $EG_{k,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit in year *y*
Measured/calculated/ default	Default
Source of data	Electricity generation data per power plant/unit: AMM´s Generation Reports, www.amm.org.
Value(s) of monitored parameter	See attached Excel spreadsheets titled: *'2019 EF Calculation Choloma 2nd crediting period'*
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	These values are determined annually during the crediting period for the relevant year as per the 'Tool to calculate the emission factor for an electricity system'.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	Use of official data sources.
Purpose of data/parameter	Calculation of the CO_2 emission factor of the grid electricity in year *y*
Additional comments	Not applicable.

Data/Parameter	$EF_{CO2,m,l,y}$
Unit	Tco_2/TJ
Description	CO_2 emissions factor of fuel type *l,* used in generating units *m and k.*
Measured/calculated/ default	Default
Source of data	IPCC Guidelines 2006, chapter I, volume 2 (Energy).
Value(s) of monitored parameter	<table><tr><td></td><td>Lower confidence interval tCO2/TJ</td></tr><tr><td>Diesel oil</td><td>72.60</td></tr><tr><td>Residual fuel oil</td><td>75.50</td></tr><tr><td>Bituminuos coal</td><td>89.50</td></tr><tr><td>Natural gas</td><td>54.30</td></tr></table>
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Not applicable.
Calculation method (if applicable)	Default values for emission factors of fossil fuels at the lower limit of the uncertainty at 95% of confidence interval are used annually during the crediting period for the relevant year, in accordance to the 'Tool to calculate the emission factor for an electricity system'.
QA/QC procedures	Not applicable.
Purpose of data/parameter	Calculation of the CO_2 emission factor of the grid electricity in year *y*
Additional comments	Not applicable.

Data/Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Unit	Not applicable.
Description	Average net energy conversion efficiency of power unit *m* or *k* in year *y*
Measured/calculated/ default	Default
Source of data	These values are determined annually during the crediting period for the relevant year in accordance to Meth tool 09.
Value(s) of monitored parameter	<table><tr><th>Technology</th><th>y≤2000</th><th>2000<y≤2012</th><th>>2012</th></tr><tr><td>Coal</td><td>37%</td><td>39%</td><td>39%</td></tr><tr><td>Oil:</td><td></td><td></td><td></td></tr><tr><td>Steam turbine</td><td>37.5%</td><td>39%</td><td>44%</td></tr><tr><td>Reciprocal gas engine</td><td>33%</td><td>40%</td><td>49%</td></tr><tr><td>Open cycle</td><td>30%</td><td>39.5%</td><td>42%</td></tr><tr><td>Combined cycle</td><td>46%</td><td>60%</td><td>62%</td></tr><tr><td>Cogeneration</td><td></td><td></td><td></td></tr><tr><td>Steam turbine</td><td colspan="3">83.5%</td></tr></table>
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Not applicable.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	Not applicable.
Purpose of data/parameter	Calculation of the CO_2 emission factor of the grid electricity in year *y*
Additional comments	Not applicable.

D.3. Implementation of sampling plan

Not applicable.

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

The emission factor of the electrical system is calculated, following the procedures established in the approved "Tool to calculate the emission factor for an electricity system", version 7.0.

As indicated in the Project Design Document, baseline emissions are calculated as follows:

$$BE_y\ (tCO_2) = EG_{BL,y}\ (MWh) * EF_{CO2,grid,y}\ (t\ CO_2/MWh)$$

Where:

BE_y = Emission in year *y* (t CO_2)

$EG_{BL,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,grid,y}$ = CO_2 emission factor of the grid calculated ex-post in year 2019 (tCO_2/MWh)

y = years 2019

Chosen options from the tool (Tool to calculate the emission factor for an electricity system, version 7.0.) are explained in section B.6.1. "*Explanation of methodological choices*" of the approved Project Design Document: https://cdm.unfccc.int/filestorage/j/m/EACGS7XNML4WFQBJYVT6928ZOP05K3.pdf/SSCPDD_Choloma.pdf?t=RHp8cTAzbGhofDCJjMRmd2QO7UvwdZmDOIWJ.

$$EF_{grid,CM,y}\ (t\ CO_2/MWh) = EF_{grid,OM,y} \bullet W_{OM} + EF_{grid,BM,y} \bullet W_{BM}$$

Where:

$EF_{grid,CM}$ = Combined emission factor of the grid (CO_2 emission factor of the grid) in year y (tCO_2/MWh)

$EF_{OM\,y}$ = Operating Margin emission factor (t CO_2/MWh)

$EF_{BM\,y}$ = Building Margin emission factor (t CO_2/MWh)

W_{OM} = Weighting of operating margin emissions factor (%)

W_{BM} = Weighting of build margin emissions factor (%)

The Operating Margin emission factor is calculated using next equation:

$$EF_{grid,OM-adj,y} = (1-\lambda_y) \bullet \frac{\sum_m EG_{m,y} \bullet EF_{EL,m,y}}{\sum_m EG_{m,y}} \oplus \lambda_y \bullet \frac{\sum_k EG_{k,y} \bullet EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

Where:

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year y (t CO_2/MWh).

y = 2019

λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y.

$EF_{EL.m,y}$ = CO_2 emission factor of power unit *m* in year *y* and given in tCO_2/MWh. It is determined using Equation 2.

$EF_{EL,k,y}$ = CO_2 emission factor of power unit *k* in year *y* and given in tCO_2/MWh. It is determined using Equation 2.

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh). These data are obtained directly from the Monthly Generation per plant Report published on AMM´s website.

$EG_{k,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *k* in the year y (MWh). These data are obtained directly from the AMM´s Monthly Generation per plant Report published on AMM´s website.

m = All grid power units serving the grid in year *y* except low-cost/must-run power units.

k = All low-cost/must run grid power units serving the grid in year *y*.

The emission factor for the subset of power plants, $EF_{EL,m,y}$ and $EF_{EL,k,y}$, connected to Interconnected National System, SNI, is calculated as per option A2 stated in the tool, using the average CO_2 emission factor of fuel type *i* used in each generating unit and the default efficiencies, as describes the following equation:

$$EF_{EL\ m,,y} = \frac{EF_{co2,m,i,y} \bullet 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$ = Emission factor of power units *m* in year y, given in tCO_2/MWh

$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fuel type *i,* used in power unit *m* in year *y*, given in tCO_2/TJ.

3.6 = Energy conversion factor, given in TJ/MWh according to the International System Units.

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio).

m = All power units serving the grid in year *y* except low-cost/must-run power units

y = 2019

$$EF_{EL\ k,,y} = \frac{EF_{co2,k,i,y} \bullet 3.6}{\eta_{k,y}}$$

Where:

$EF_{EL,k,y}$ = Emission factor of power units *k* in year y, given in tCO_2/MWh

$EF_{CO2,k,i,y}$ = Average CO_2 emission factor of fuel type *i,* used in power unit *k* in year *y*, given in tCO_2/TJ.

3.6 = Energy conversion factor, given in TJ/MWh according to the International System Units.

$\eta_{k,y}$ = Average net energy conversion efficiency of power unit *k* in year *y* (ratio).

k = Low-cost/must-run power units

y = 2019

Lambda is fixed with the values in table calculated as follows:

$$\lambda(\%) = \frac{Number\ of\ \ low-cost/must-run\ sources\ are\ on\ the\ margin\ in\ year\ y}{8760\ hours\ per\ year}$$

The build margin is calculated using the following equation:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \bullet EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,BM,,y}$ = Building Margin CO_2 emission factor in year *y* (t CO_2/MWh)

$EF_{EL,m,y}$ CO2 emission factor of power unit *m* in year *y* (tCO2/MWh). It is determined using equation 2 according to option A2 of the Tool.

y = 2019

$EG_{m,y}$ Net quantity of electricity generated and delivered to the grid by power unit *m*, during the year *2019*, given in MWh.

m = Power units included in the build margin

Baseline emissions are computed using the spreadsheet called *'2019 EF Calculation Choloma 2nd crediting period'*

Emission factor	Ex-post option 2019
Operating Margin	0.615
Build Margin	0.374
W_{OM}	0.250
W_{BM}	0.750
Combined Margin	**0.434**

Table 1. Yearly baseline emissions calculation

Step 1. Entry variable $EG_{BL,y}$

Step 2. The baseline emissions of the project are calculated automatically for each month of the monitoring period in the sheet called '*Energy data and CERs calculations – 3rd Monitoring Period -2nd CP*'. Results are shown in the following table:

Name of the variable	$EG_{BL,y}$	$EF_{CO2,grid,y}$	BE_y
Description	Net electricity generation from the proposed project activity	Emission factor	Baseline emissions
Unit	MWh	t CO_2/MWh	t CO_2e
2019	20,033	0.434	8,694

Table 2. Yearly baseline emissions calculation

Monthly results are shown in the following table, and included in the Excel spreadsheet:

Cholomá Hydroelectric Plant
Calculation of Emission Reductions
Period: January 2019 to December 2019, 3rd Monitoring Period 1st CP ***Grid emission factor as per PDD: 0.434***

Year	Month	Energy generation (MWh)	Emission reductions (tCO_2e)
2019	January	776	337
	February	567	246
	March	315	137
	April	243	105
	May	623	270
	Jun	2,171	942
	Jul	2,445	1,061
	Ago	1,793	778
	Sep	3,751	1,628
	Oct	3,934	1,707
	Nov	1,946	845
	Dic	1,468	637
TOTAL		**20,033**	**8,694**

Table 3. Monthly baseline emissions calculation and GHG emission reductions

E.2. Calculation of project emissions or actual net removals

Project emissions are negligible since power density (2,585.31W/m_2) results greater than 10 W/m^2. Installed capacity and reservoir areas remain constant as described in the PDD.

E.3. Calculation of leakage emissions

Leakages are negligible according to the PDD.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)			
				Before 01/01/ 2013	From 01/01/ 2013 until 31/12/ 2020	From 01/01/ 2021	Total amount
Total	8,694	0	0	0	8,694	0	8,273

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
8,694	18, 926 tCO2e

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

According to the registered PDD, the calculation of the amount of GHG emissions reductions estimated ex ante for this monitoring period is as follows:

Month	PE_y	BE_y	LE_y	ER_y
	Estimation of project activity emissions	Estimation of baseline emissions	Estimation of leakages	Estimation of emission reductions
	t CO_2e	t CO_2e	t CO_2e	t CO_2e
Definition	**A**= 0 because power density > 10w/m^2	**B**	**C**	**A - B - C**
2019	0	18,926	0	18,926
Total	**0**	**18,926**	**0**	**18,926**

Where the baseline emissions estimated ex ante are calculated using a combined emission factor of the grid of 0.518 t CO_2/MWh and a yearly estimation for the net electricity supplied by the project activity to the grid of 36,538 MWh.

Variable	$EG_{BL,y}$	$EF_{CO2,grid.y}$	BE_y
Description	**Net electricity supplied by the project activity to the grid**	**Emission factor**	**Baseline emissions**
Unit	**MWh**	**t CO_2/MWh**	**t CO_2**
Definition	**A**	**B**	**A*B**
2019	36,538	0.518	18,926
Total	**36,538**		**18,926**

E.6. Remarks on increase in achieved emission reductions

Actual GHG emission reductions achieved is not greater than the amount based on the ex-ante estimation in the registered PDD.

E.7. Remarks on scale of small-scale project activity

Project activity consists just of Choloma Hydroelectric Project (9.7 MW), and not a bundle of project activities. Since there has not been any changes to Choloma's installed capacity, the project activity remains under the limit of that type (15 MW).

Document information

Version	*Date*	*Description*
08.0	6 April 2021	Revision to: • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • 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: • 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 *F-CDM-MR* to *CDM-MR-FORM*; • 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 (EB 70, Annex 11).

Version	*Date*	*Description*
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report