# Monitoring report form (Version 03.0)

## Monitoring report

| | |
|---|---|
| **Title of the project activity** | El General Hydroelectric Project |
| **Reference number of the project activity** | 4988 |
| **Version number of the monitoring report** | 1.0 |
| **Completion date of the monitoring report** | 31/01/2013 |
| **Registration date of the project activity** | 27/03/2012 |
| **Monitoring period number and duration of this monitoring period** | 1st monitoring period, 27/03/2012 – 31/12/2012 |
| **Project participant(s)** | Hidroenergia Del General S.R.L. |
| **Host Party(ies)** | Costa Rica |
| **Sectoral scope(s) and applied methodology(ies)** | Sectoral scope 1, ACM0002 Version 12.1 |
| **Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD** | 50492.57 $tCO_2$ (Pro rata for 280/366 days from 66001 $tCO_2$, which was estimated for the whole year 2012) |
| **Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period** | 51304 $tCO_2$ |

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

The purpose of the project activity is the production of electricity with a capacity of 40MW with an expected average annual net generation of approximately 198,380MWh.

The El General Hydroelectric Project (EGHP) is a hydroelectric power plant consisting of two vertical shaft turbines with a combined capacity of 40MW. The electricity is sold to ICE (Instituto Costarricense de Electricidad), the government owned state enterprise responsible for the generation, transmission and distribution of electricity in Costa Rica.

Through the implementation of this project, renewable electricity is generated and sold to the Costa Rican grid, avoiding the dispatch of energy produced by fossil-fuelled thermal plants to that grid. The initiative avoids $CO_2$ emissions and contributes to the regional and national sustainable development. The project coincides with Costa Rica's long term development and energy strategy to provide electric energy from small-scale, renewable sources (wind, biomass, hydro, geothermic).

It is a BOT (Build-Operate-Transfer) type project. Hidroenergía Del General, S.R.L., the developer of the project, received a concession from ICE to design, construct, and operate EGHP for 17 years. After that, the ownership of the EGHP will be transferred back to ICE.

Table 1 below shows relevant dates for the project activity:

Table 1. EGHP relevant dates

| Date | Milestone |
|---|---|
| 06/01/2004 | Construction Starting date |
| 28/01/2006 | Start of the commissioning period |
| 24/04/2006 | Commercial Operation Date (COD) Unit 1 |
| 10/05/2006 | Commercial Operation Date (COD) Unit 2 |

The total emission reductions achieved in this period is 51304 $tCO_2e$.

### A.2. Location of project activity

The project EGHP is located in the provinces of Heredia and Limón, Costa Rica, 50 km from San José and 102 km from Limón Harbor in the Atlantic Cost. It is on the left bank of the General River, downstream of the Braulio Carrillo National Park. The power plant is located in Sarapiquí county, the water intake is located in Varablanca district of Heredia county; and the transmission line is located in Pococí county. Geographic coordinates of the power plant: 10°12'49"N; -83°54'56"W.

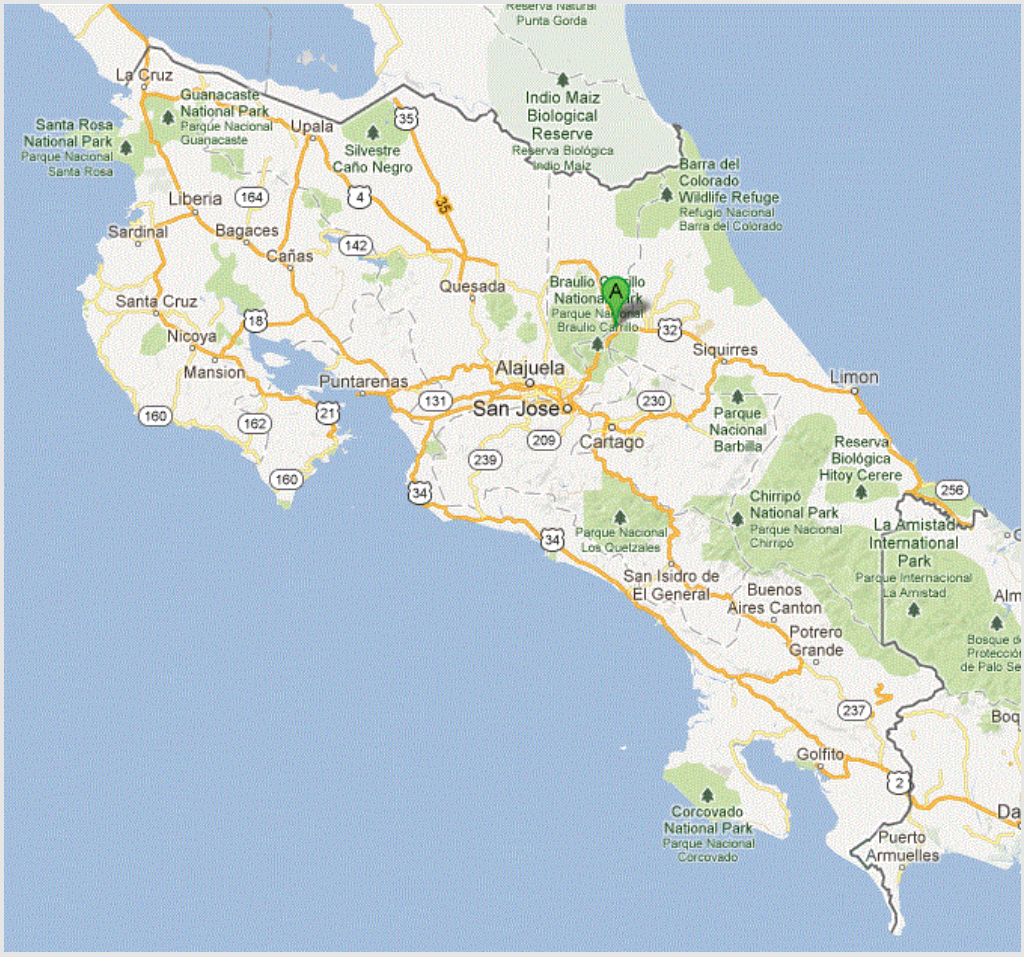


Figure 1. Costa Rica and location of EGHP (source: Google Maps)

## A.3. Parties and project participant(s)

| Party involved<br>((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) |
|---|---|---|
| Costa Rica | Hidroenergia Del General S.R.L. (private entity) | No |

## A.4. Reference of applied methodology

- ACM0002 ver. 12.1 – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 12.1).
- "Tool for the demonstration and assessment of additionality" (Version 05.2)
- "Tool to calculate the emission factor for an electricity system" (Version 02)

## A.5. Crediting period of project activity

27 Mar 2012 - 26 Mar 2019, being 7 years (renewable)

**SECTION B. Implementation of project activity**

**B.1. Description of implemented registered project activity**

The hydroelectric power plant considered in this report, was fully operational on the 10th of May 2006. The power plant is operational accordingly to the registered PDD, i.e. no modifications took place since the CDM project activity was registered (including the main equipments).

The project consists of a compact diversion dam 60 meters long and 6 meters height. The dam diverts a design flow of 18.5m³/s from the Río General to the intake structure. After that, the water flows in an open-canal of 930m to the ridge adjacent to Río General. From the canal, the water flows through a concrete pipe with a diameter of 3.8 meters and a length of 3400 m extending to a day reservoir, excavated at the end of the ridge. The purpose of this day reservoir is to manage daily output to match ICE's load profile. The maximum water level of the reservoir is 492m (above sea level) and the capacity of the reservoir is 194903 m³. Then, the water flows through a 2400 meter penstock (steel pipe) with a diameter of 3.25 m to the powerhouse.

Table 2. Technical data of the turbines

| Manufacturer | Type | Capacity | Maximum Consumption | Maximum water head | Velocity |
|---|---|---|---|---|---|
| General Electric (Norway) AG | Francis | 2 x 20.7 MW | 9.25 m³/s | 247.6 m | 720 rpm |

Table 3. Technical data of the generators

| Manufacturer | Type | Capacity | Capacity factor | Tension / Frequency | Nominal current | Velocity |
|---|---|---|---|---|---|---|
| General Electric-INEPAR (Brazil) | ATI Synchronico | 2 x 23,530 kVA = 2 x 20 MW | 0.85 | 13,800 V / 60 Hz | 984 A | 720 rpm |

Each generator is connected to a booster transformer (13,8kV/230kV) and further connected to a 230kV rail at the EGHP substation. From this 230kV rail, a 21.5km long transmission line (230kV) connects to the Leesville substation where the measuring equipment is located.

The layout of the connections of the project activity and the monitoring system is represented in Figure 2.

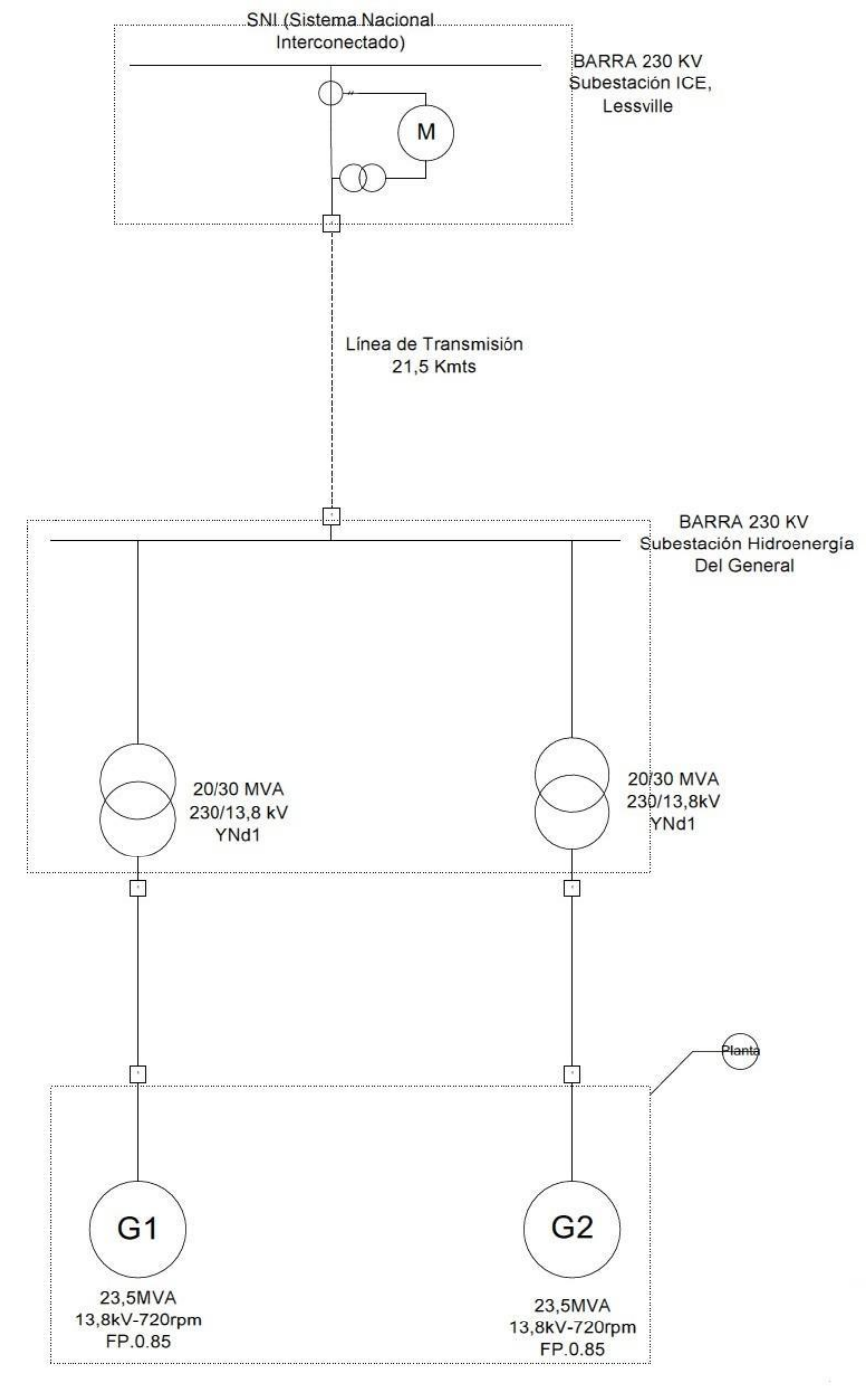


Figure 2. Layout of the connections of the project activity and the monitoring system

Contractual agreements between EGHP and the grid operator ICE influence the operational performance. This means that for certain hours of the night ("night" is defined from 22h00 until 06h00 next day), EGHP can only operate for a few hours ("nightly delivery hours"), depending on the season:

- Dry season (February-March-April): EGHP can operate only for 2 hours (from 04h00 until 06h00)
- Wet season (May-January): EGHP can operate only for 5 hours (from 01h00 until 06h00)

The energy that has been delivered to the grid outside the contractual determined "nightly delivery hours" is not recognized by the grid operator ICE and will be considered as "not received" and hence, not paid for.

Since the commissioning of the project, no significant operational problems have prevented EGHP for dispatching on its full capacity. In the month of July 2012, Unit 2 has some problems with the rotor and needed unscheduled maintenance. During the month of October 2012, Unit 2 had a major scheduled

maintenance. Due to contractual arrangements with ICE, there is a contractual downtime for each month (see above, “nightly delivery hours”), which are different depending on the season. During the dry season, EGHP needs to shut down during the night for 6 hours, during the wet season during 3 hours.

The results of these events are shown in Table 4 below:

Table 4. EGHP availability (sourced by EGHP)

| Months (2012) | Forced Maintenance 2 Units (Hrs) | Scheduled Maintenance 2 Units (Hrs) | Contractual Downtime 2 Units (Hrs) | Availability [Operation time] 2 Units (Hrs) |
|---|---|---|---|---|
| 27-31 March | 0.00 | 4.83 | 60.00 | 175.17 |
| April | 3.55 | 108.67 | 360.00 | 967.78 |
| May | 3.32 | 76.42 | 186.00 | 1222.27 |
| June | 1.27 | 41.78 | 180.00 | 1216.95 |
| July | 131.32 | 72.00 | 186.00 | 1098.68 |
| August | 1.72 | 58.47 | 186.00 | 1241.82 |
| September | 4.07 | 157.03 | 180.00 | 1098.90 |
| October | 1.90 | 651.27 | 186.00 | 648.83 |
| November | 1.28 | 80.75 | 180.00 | 1177.97 |
| December | 37.42 | 19.93 | 186.00 | 1244.65 |
| TOTAL | 185.83 | 1271.15 | 1890.00 | 10093.02 |

Based on the aforementioned, the events and situations that occurred during this monitoring period are exclusively related to the project operation and do not have any impact on the applicability of the methodology.

### B.2. Post registration changes

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

No temporary deviations from registered monitoring plan or applied methodology for this monitoring period.

#### B.2.2. Corrections

No corrections for this monitoring period.

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

No permanent changes from registered monitoring plan or applied methodology for this monitoring period.

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

No changes to project design of registered project activity for this monitoring period.

#### B.2.5. Changes to start date of crediting period

No changes to start date of crediting period.

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

Not applicable.

**SECTION C. Description of monitoring system**

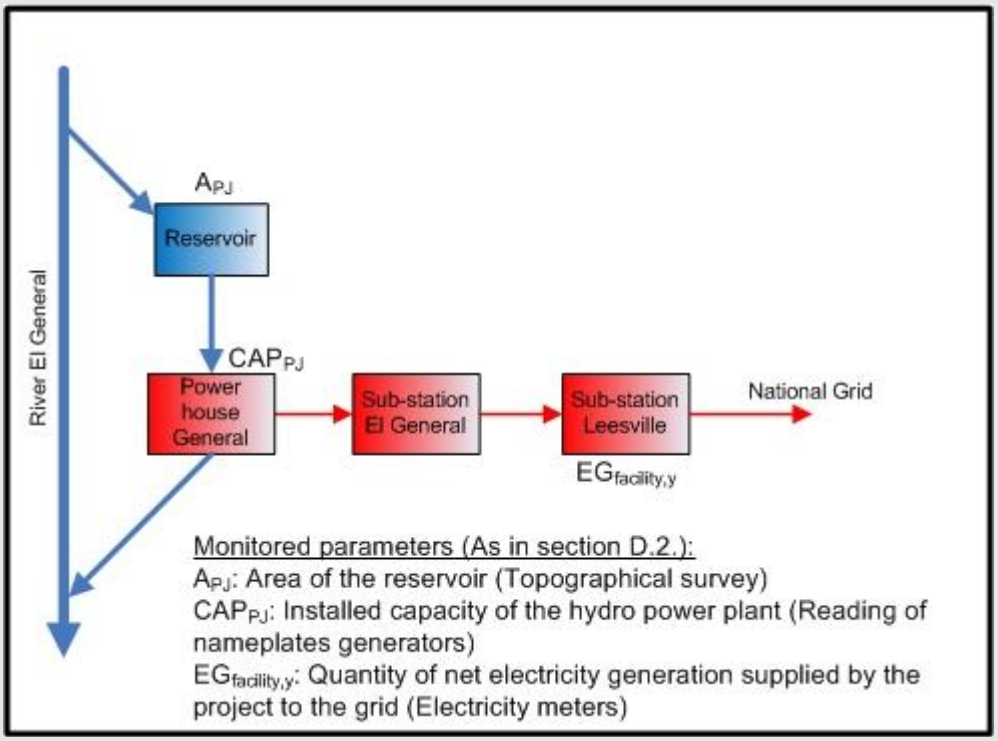


Figure 3. Description of the monitoring system.

1. $AP_J$: The area of the reservoir measured on the surface of the water, after the implementation of the project activity, when the reservoir is full, is determined during a topographical survey by third party (TECHTOPO, topographical survey of 21th of February 2012)

2. $CAP_{PJ}$: The installed capacity of the hydro power plant is determined at the project site by reading the name plates of the generators.

3. $EG_{facility,y}$: The description of the monitoring system for this parameter is described in detail here below:

3.1. Data generation

Data generation is done by a main and backup energy meter (both ION 7550, bidirectional electricity meters) located at the Leesville substation, at 21.5km from the power plant, as detailed on section D.2. These equipments measure the delivered and received electricity to/from the national grid.
The data measured by the backup meter can secure the measurement in case of failure of the main meter.

3.2. Data recording, handling and reporting

Data Recording is done by using ION Setup software which downloads the raw data from the measuring devices. In the beginning of the month, the Financial Manager uses this software to extract (to an electronic .txt-file, stored on the server) the monthly raw data from the concerned ION 7550 metering device. This dataset contains the values of delivered and received power (kW) with a time stamp of 1 minute from 06h01 of the first day of the month until 06h00 of the first day of the next month (which is for contractual reasons defined as the “invoicing month”), and is transferred to a monthly spreadsheet where calculations and (contractually determined, value reducing) adjustments are made to the measured values for delivered power, in order to create the values that contractually may be used for invoicing purposes. These calculations are sent to ICE for approval. After approval by ICE, the invoice is made and sent to ICE.

The spreadsheet with raw data (.txt-file) is also transferred to a CDM-file where the measured values for delivered and received power are used to calculate the delivered and received energy for each month. These values for delivered and received energy for each month are represented in a summary sheet. The

total delivered and received energy is calculated by integrating the 1'-timestamp values of delivered and received power (kW) over the whole month (in practice, this is the sum of each 1'-timestamp value, divided by 60 – which determines the kWh from kWmin).

Data sets of each month (raw data and invoice values) start at 06h01 on the first day of the month and ends at 06h00 on the first day of the next month.

3.3. Data control

Before approving the invoice data, ICE performs a control. Once ICE gives their approval, the invoice data is considered as verified and correct.

The invoices for delivered electricity to the grid mention two different values, being:

- Energia Entregada (EE): This value is the total delivered energy (MWh) to the grid (measured by the monitoring equipment) MINUS the delivered energy to the grid during the contractual defined hours in which the grid operator ICE considers the received energy as "not received" (as explained in section B.1).
- Energia Ajustada (EA): This value (MWh) is calculated from Energia Entregada (EE), MINUS the other contractual agreed conditions where the grid operator ICE does not pay for certain fractions of the energy received from EGHP.

For performing the cross check of the measured values from the monitoring equipment with the invoices and sales receipts, we should note that the invoice value, closest to the measured value from the monitoring equipment is Energia Entregada (EE). This value is lower then the measured values (real delivered energy to the grid), due to the fractions of energy that, for contractual reasons, are considered by ICE as "not received". For performing the cross check, the raw meter data is used for the same time block as mentioned on the invoices. Knowing that the cross check with the invoices shows a small difference, and choosing the most conservative approach, the lowest value between Energia Entregada (EE) and the main meter data is used for the calculation of the baseline emissions.
For the calculation of the baseline emissions, the data is used for the exact time block as the monitoring period (see last paragraph of 3.2. here above)

In the summary sheet of the CDM-file, there are columns foreseen for entering the value that is mentioned on the invoice for sold electricity ("Energia Entregada" EE) and the value that is mentioned on the invoice for received electricity. This enables the project owner to automatically perform the crosscheck for the consistency of the monitoring data (as required by the methodology ACM0002 Version 12.1) on a monthly basis. This data is reviewed by the Project Owner monitoring manager on a monthly basis.

Note: The calculation method that is used by the grid operator ICE to calculate the invoice values for imported kWh by EGHP from the grid is based on a different approach (the grid operator charges for consumption and the availability of the energy). This causes a difference between the invoice value for imported kWh and the value of imported kWh based on raw meter data.
In order to be conservative, we use the most conservative (highest) monthly value of imported kWh (either the values from the metering device raw data or from the invoice from ICE) for the calculation of the net delivered energy to the grid.

3.4. Data archiving

All electronic files of raw data are stored on a server. Daily raw data is stored on the server at the power plant. Monthly raw data is stored on the server at the main office (located in Ciudad Quesada). The calculation files for monthly invoicing and the CDM-file are also stored on the server in the main office.
The server is equipped with redundant power supply to prevent problems during an eventual power outage. The hard disks on the server are in placed RAID (mirroring), so data is written identically to two drives, thereby producing a "mirrored set" of data.
The data from the measuring devices is automatically uploaded in the data base of the ION Enterprise software (installed on the server at the power plant).
The software ION Enterprise makes an automatic daily backup of all the data since the start of operation and stores the last four backup files (backups from the last four days).
In case of failure of communication with the Leesville substation, the monitoring equipment has a capacity to

store data in an autonomous way for 45 days. Once the communication with the server has been restored, the data will be automatically uploaded in the ION Enterprise data base located at the server in the power plant.
The server at the main office, is equipped with a UPS-unit to guarantee power supply for up to 20 minutes in case of power outage. The system of hard disks is configured in “mirror”, so data is written identically to two drives, thereby producing a "mirrored set" of data. The folder with all the generation data is backed up every week to an external hard disk which is kept in a secured place in the office.

### 3.5. Organizational structure

The structure that EGHP has to operate and also to monitor this project activity is presented in the organization chart below (Figure 4 - in white color the personnel involved with CDM monitoring activities):

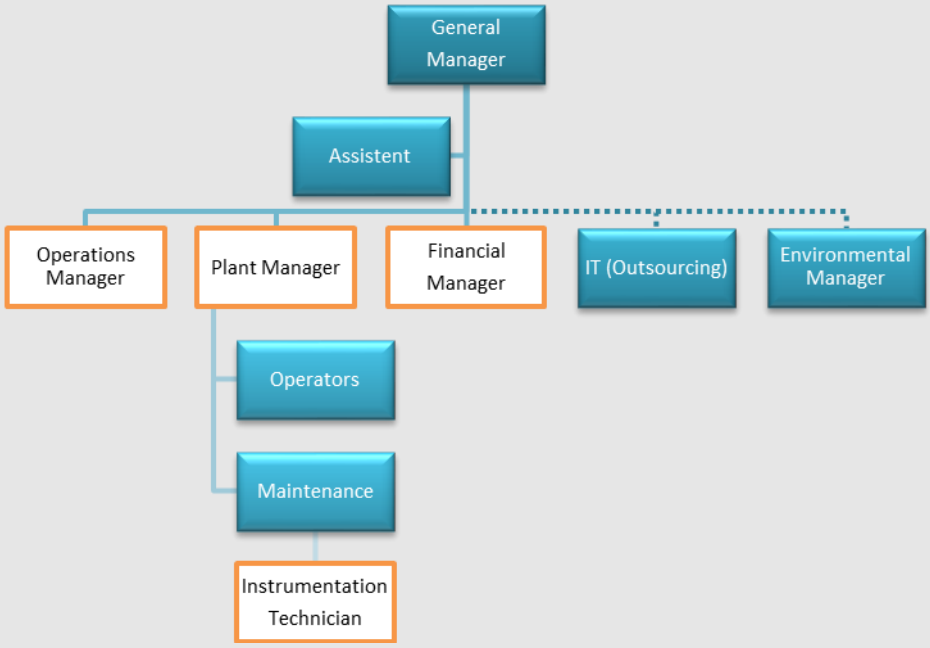


Figure 4. EGHP organizational structure

The Operations Manager (which is in fact the Project Owner monitoring manager) has the responsibility for the CDM monitoring activities, which includes among others:

- Guarantee correct monitoring of data listed in the monitoring plan;
- Guarantee well functioning and calibration of monitoring equipment;
- Be responsible for the data generation, data recording, handling and reporting, data control and data archiving;
- Prepare periodic internal reporting;

Some tasks that are under the Operations Manager responsibility are delegated to plant personnel and to the financial manager. (e.g. the Plant Manager and the Instrumentation Technician are assisting ICE during the calibration of the measurement equipment; The Financial Manager extracts the raw data from the measuring devices every month and stores the extracted data file to the server)
EGHP personnel, involved with CDM monitoring were trained to perform the required tasks.

**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:** | **$EF_{grid,CM,2005-2007}$** |
|---|---|
| Unit: | **$tCO_2/MWh$** |
| Description: | Combined margin $CO_2$ emission factor for the grid connected power generation in year y calculated using the "Tool to calculate the emission factor for an electricity system" version 02. |
| Source of data: | Registered PDD |
| Value(s) applied): | 0.3327 |
| Purpose of data: | Calculation of baseline emissions |
| Additional comment: | The emission factor of the project was ex-ante determined and is fixed during the crediting period. All data and parameters have been determined at registration. |

| **Data / Parameter:** | **$CAP_{BL}$** |
|---|---|
| Unit: | **W** |
| Description: | Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero. |
| Source of data: | Registered PDD |
| Value(s) applied): | 0 |
| Purpose of data: | Calculation of project emissions |
| Additional comment: | - |

| **Data / Parameter:** | **$A_{BL}$** |
|---|---|
| Unit: | **$m^2$** |
| Description: | Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full ($m^2$). For new reservoirs, this value is zero. |
| Source of data: | Registered PDD |
| Value(s) applied): | 0 |
| Purpose of data: | Calculation of project emissions |
| Additional comment: | - |

**D.2. Data and parameters monitored**

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

| **Data / Parameter:** | **$EG_{facility,y}$** |
|---|---|
| Unit: | **MWh/yr** |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Measured/ Calculated / Default: | Measured |
| Source of data: | Electricity measurement instrument |
| Value(s) of monitored parameter: | See table below |
| Monitoring equipment: | Manufacturer: Schneider Electric<br>Type: ION7550<br>Accuracy class: 0.2[1]<br>Serial number: PI-0510A007-01<br>Calibration frequency: 6 months<br>Date of previous calibration: 29/11/2011[2]<br>Validity: 28/05/2012<br>Date of calibration: 26/06/2012[3]<br>Validity: 25/12/2012;<br><br>This monitoring equipment was replaced by a new one on the 19th December 2012:<br>Manufacturer: Schneider Electric<br>Type: ION7550<br>Accuracy class: 0.2<br>Serial number: PI-1210A422-03<br>Calibration frequency: 6 months<br>Date of last calibration: 19/12/2012[4]<br>Validity: 18/06/2013 |

| **Period (DD/MM/YYYY)** | | **Net electricity supplied to the grid [Delivered minus Received] (MWh)** |
|---|---|---|
| **From** | **To** | |
| 27/03/2012 | 31/03/2012 | 3 042.96 |
| 01/04/2012 | 30/04/2012 | 14 661.15 |
| 01/05/2012 | 31/05/2012 | 17 437.42 |
| 01/06/2012 | 30/06/2012 | 15 324.26 |
| 01/07/2012 | 31/07/2012 | 15 136.25 |
| 01/08/2012 | 31/08/2012 | 17 667.25 |
| 01/09/2012 | 30/09/2012 | 15 988.20 |
| 01/10/2012 | 31/10/2012 | 12 334.04 |
| 01/11/2012 | 30/11/2012 | 20 684.59 |
| 01/12/2012 | 31/12/2012 | 21 995.79 |
| **27/03/2012** | **31/12/2012** | **154 271.90** |

[1] ION 7550 datasheet

[2] Report no.: CENCE-PST-P-20111129-GEN. This document has been made available to the auditors.

[3] Report no.: R03-IME-01-01 (dd. 26/06/2012). This document has been made available to the auditors. Note: In the in-situ report of this calibration we noticed a typo-error (2011 instead of 2012). ICE, who performed the calibration, provides a declaration to confirm that this calibration took place in 2012.

| | |
|---|---|
| Measuring/ Reading/ Recording frequency: | Continuous measurement and recording every minute |
| Calculation method (if applicable): | - |
| QA/QC procedures: | A backup meter (ION7550, Serial number: PI-1007A328-02, accuracy class 0.2) is installed and can be used in case of mal-functioning of the main meter. The 19th of December 2012, the main meter has been replaced by a new one. The display was broken but the device was still measuring correctly. Anyhow, ICE requested to replace it by a new device. During the time of replacement (10h30 to 14h51), the backup meter data has been used to determine the generation data. Also during calibration of the main meter, the backup meter data is used to determine the generation data for that period of time. The backup meter is calibrated in the same day as the main meter and the calibration results are included in the calibration report.<br><br>In addition, the values are cross checked with records for delivered electricity and invoices for received electricity. Due to a different calculation approach by ICE for the imported electricity from the grid, the invoice value is different from the value that is based on raw metering data. The most conservative value (highest) of both is used for imported kWh from the grid in the emission reduction calculation.<br><br>The calibration was delayed from 28/05/2012 to 26/06/2012. The project participants followed the Annex 60 of the EB 52 guidelines[5], and for this period used the maximum between: a) the maximum permissible error as declared by the manufacturer and b) the error identified in the delayed calibration. In this case, the maximum permissible error was used (0.2%). |
| Purpose of data: | Calculation of baseline emissions |
| Additional comment: | - |

| **Data / Parameter:** | **$CAP_{PJ}$** |
|---|---|
| Unit: | W |
| Description: | Installed capacity of the hydro power plant after the implementation of the project activity. |
| Measured/ Calculated / Default: | Measured |
| Source of data: | Project site |

[4] Report no.: R03-IME-01-01 (dd. 19/12/2012). This document has been made available to the auditors.

[5] Guidelines for assessing compliance with the calibration frequency requirements (version 01.0)

| | |
|---|---|
| Value(s) of monitored parameter: | Total installed capacity: 40MW<br>Generator Unit 1: Serial number G091: Capacity 20MW<br>Generator Unit 2: Serial number G092: Capacity 20MW |
| Monitoring equipment: | Visual reading of name plates of the generators |
| Measuring/ Reading/ Recording frequency: | Yearly |
| Calculation method (if applicable): | - |
| QA/QC procedures: | Between the installed capacities of the generators and turbines, the installed capacity of the generators is the most conservative (lowest) and is used for the calculation of project emissions |
| Purpose of data: | Calculation of project emissions |
| Additional comment: | - |

| **Data / Parameter:** | **$A_{PJ}$** |
|---|---|
| Unit: | $m^2$ |
| Description: | Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full. |
| Measured/ Calculated / Default: | Measured |
| Source of data: | Project site |
| Value(s) of monitored parameter: | 44795.103$m^2$ |
| Monitoring equipment: | Topographical survey by third party (see confirmation letter from TECHTOPO, 21th of February 2012) |
| Measuring/ Reading/ Recording frequency: | Yearly |
| Calculation method (if applicable): | - |
| QA/QC procedures: | - |
| Purpose of data: | Calculation of project emissions |
| Additional comment: | - |

**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 include only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$

Where:

$BE_y$ = Baseline emissions in year *y* ($tCO_2$);

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh);

$EF_{grid,CM,y}$ = Combined margin $CO_2$ emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2$/MWh);

The $EF_{grid,CM,y}$ was calculated at the moment of the PDD registration and the fixed ex-ante value (using data from years 2005, 2006 and 2007), as stated in section D.1 of this report is 0.3327 $tCO_2$/MWh.
The calculation of $EG_{PJ,y}$ is different for (a) Greenfield plants, (b) retrofits and replacements, and (c) capacity additions. EGHP is a Greenfield plant; consequently option (a) has been used:

**(a) Greenfield renewable energy power plants**

If the project activity is the installation of a grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$EG_{PJ,y} = EG_{facility,y}$

Where:

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh);

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in the year *y* (MWh)

EGHP is a greenfield renewable energy power plant, so consequently,
$BE_y = EG_{PJ,y} \times 0.3327$

After the cross check with invoice data, and in order to be conservative with the calculation of the baseline emissions, we use the most conservative data between the main meter data and the invoice data. As explained in section C.3.3 of this document and shown in the CER calculation sheet (CDM-CER-4988-12 03 27-12 12 31.xls), the invoice data is lower (more conservative) then the main meter data. As a result, the invoice data (Energia Entregada) is used to calculate the baseline emissions.

As explained in section C.3.2 of this document, the data is based on the "invoicing month" which starts at 06h01 on the first day of the month and ends at 06h00 of the first day of the next month. In order to correctly calculate the baseline emissions (00h01 first day of monitoring period until 24h00 last day of monitoring period), the last six hours of the last month of the monitoring period will be excluded. For the same reason, the first six hours of the first day of the monitoring period will be included.

Determination of the invoice value for 27-31 March including the first six hours of 27th of March:
The most conservative value of following two calculation approaches is used: (1st approach is based on the hourly average, 2nd approach is based on the ratio between main meter data for the invoicing month and main meter data for 27-31 March including the first six hours of 27th of March)

1. Total invoice value March 2012 x $\frac{\text{Hours from 27.03.2012@00h01 until 01.04.2012@06h00}}{\text{Hours from 01.03.2012@06h01 until 01.04.2012@06h00}}$

$$18147.75 \text{ MWh} \times \frac{126 \text{ h}}{744 \text{ h}} = 3073.40927 \text{ MWh}$$

2. Total invoice value March 2012 x $\frac{\text{Main meter data from 27.03.2012@00h01 until 01.04.2012@06h00}}{\text{Main meter data from 01.03.2012@06h01 until 01.04.2012@06h00}}$

$$18147.75 \text{ MWh} \times \frac{3061.73 \text{ MWh}}{18246.57 \text{ MWh}} = 3045.14824 \text{ MWh}$$

Using the most conservative value from the approaches here above for the invoice data from 27.03.2012@00h01 until 01.04.2012@06h00 gives us: 3045.14824 MWh.

Determination of the invoice value for December excluding the last six hours of the invoicing month:
The most conservative value of following two calculation approaches is used: (1st is based on the hourly average throughout the month, 2nd is based on the ratio between main meter data for that month)

1. Total invoice value December 2012 x $\frac{\text{Hours from 01.12.2012@06h01 until 31.12.2012@24h00}}{\text{Hours from 01.12.2012@06h01 until 01.01.2013@06h00}}$

$$22184.65 \text{ MWh} \times \frac{738 \text{ h}}{744 \text{ h}} = 22005.74153 \text{ MWh}$$

2. Total invoice value December 2012 x $\frac{\text{Main meter data from 01.12.2012@06h01 until 31.12.2012@24h00}}{\text{Main meter data from 01.12.2012@06h01 until 01.01.2013@06h00}}$

$$22184.65 \text{ MWh} \times \frac{22157.50 \text{ MWh}}{22341.30 \text{ MWh}} = 22002.13785 \text{ MWh}$$

Using the most conservative value for the invoice data from 01.12.2012@06h01 until 31.12.2012@24h00 gives us: 22002.13785 MWh.

Table 5 below represents the calculation of the net exported electricity to the grid, considering the most conservative value of the imported electricity by EGHP from the grid.

Table 5. Calculation of net exported electricity to the grid

| | | V | W | A = V - W |
|---|---|---|---|---|
| **Period (DD/MM/YYYY)** | | **Most conservative value for Delivered Electricity to grid** | **Most conservative value for Received Electricity From grid** | **NET Delivered Electricity to the grid: Delivered minus Received (MWh)** |
| **From** | **To** | **(MWh)** | **230kV (MWh)** | |
| 27/03/2012 | 31/03/2012 | 3 045.15 | 2.19 | 3 042.96 |
| 01/04/2012 | 30/04/2012 | 14 674.59 | 13.44 | 14 661.15 |
| 01/05/2012 | 31/05/2012 | 17 445.08 | 7.66 | 17 437.42 |
| 01/06/2012 | 30/06/2012 | 15 332.32 | 8.06 | 15 324.26 |
| 01/07/2012 | 31/07/2012 | 15 146.51 | 10.26 | 15 136.25 |
| 01/08/2012 | 31/08/2012 | 17 674.70 | 7.45 | 17 667.25 |
| 01/09/2012 | 30/09/2012 | 15 995.32 | 7.13 | 15 988.20 |
| 01/10/2012 | 31/10/2012 | 12 340.74 | 6.70 | 12 334.04 |
| 01/11/2012 | 30/11/2012 | 20 692.61 | 8.02 | 20 684.59 |
| 01/12/2012 | 31/12/2012 | 22 002.14 | 6.35 | 21 995.79 |
| **27/03/2012** | **31/12/2012** | **154 349.16** | **77.25** | **154 271.90** |

Table 6 below represents the baseline emissions for this monitoring period:

Table 6. Baseline emissions

| | | A | B | C | D = A x B x (1 – C/100) |
|---|---|---|---|---|---|
| **Period (DD/MM/YYYY)** | | **Net delivered electricity supplied to the grid** | **Emission factor** | **Error applied in case of** | **Baseline Emissions** |
| **From** | **To** | **(MWh)** | **($tCO_2$/ MWh)** | **delayed calibration (%)** | **($tCO_2$)** |
| 27/03/2012 | 31/03/2012 | 3 042.96 | 0.3327 | 0.0 | 1 012.39 |
| 01/04/2012 | 30/04/2012 | 14 661.15 | 0.3327 | 0.0 | 4 877.76 |
| 01/05/2012 | 31/05/2012 | 17 437.42 | 0.3327 | **0.2** | 5 789.83 |
| 01/06/2012 | 30/06/2012 | 15 324.26 | 0.3327 | **0.2** | 5 088.18 |
| 01/07/2012 | 31/07/2012 | 15 136.25 | 0.3327 | 0.0 | 5 035.83 |
| 01/08/2012 | 31/08/2012 | 17 667.25 | 0.3327 | 0.0 | 5 877.89 |
| 01/09/2012 | 30/09/2012 | 15 988.20 | 0.3327 | 0.0 | 5 319.27 |
| 01/10/2012 | 31/10/2012 | 12 334.04 | 0.3327 | 0.0 | 4 103.54 |
| 01/11/2012 | 30/11/2012 | 20 684.59 | 0.3327 | 0.0 | 6 881.76 |
| 01/12/2012 | 31/12/2012 | 21 995.79 | 0.3327 | 0.0 | 7 318.00 |
| **27/03/2012** | **31/12/2012** | **154 271.90** | **0.3327** | **-** | **51 304** |

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

The project emission ($PE_y$), in accordance with the registered PDD and the methodology ACM0002 (version 12.1), should be calculated as follows:

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$

Where:
$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$);
$PE_{FFy}$ = Project emissions from fossil fuel consumption in year y ($tCO_2/yr$);
$PE_{GP,v}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensate gases in year y ($tCO_2e/yr$);
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y ($tCO_2e/yr$);

EGHP is a hydro power plant, without fossil fuel consumption. Consequently, $PE_{FF,y} = 0$ (no fossil fuel consumption), $PE_{GP,y} = 0$ (this project is not a geothermal power plant) and $PE_{HP,y} = 0$ (this hydro power project has a power density which is greater than 10W/m² - see calculation below). Consequently the Project Emissions $PE_y = 0$.

The power density of the project activity is calculated as follows:

$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL})$

Where:
PD = Power density of the project activity, in $W/m^2$;
$Cap_{PJ}$ = Installed capacity of the hydro power plant after the implementation of the project activity (W).
$Cap_{BL}$ = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero;
$A_{PJ}$ = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full ($m^2$);
$A_{BL}$ = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full ($m^2$). For new reservoirs, this value is zero.

PD = (40000000 – 0) / (44795.103 – 0) = 892,96 W/m²

**E.3. Calculation of leakage**

According to the methodology ACM0002 (version 12.1) and according to the registered PDD, no leakage emissions shall be considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction processing, transport). These emissions sources are neglected. Therefore, Leakage = 0.

**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 $CO_2e$) | Project emissions or actual net GHG removals by sinks (t $CO_2e$) | Leakage (t $CO_2e$) | Emission reductions or net anthropogenic GHG removals by sinks (t $CO_2e$) |
|---|---|---|---|---|
| **Total** | 51 304 | 0 | 0 | 51 304 |

**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 | Item | Values estimated in ex-ante calculation of registered PDD |
|---|---|---|---|---|
| **Emission reductions or GHG removals by sinks (t $CO_2e$)** | 50492.57 [6] | 51304 | Not applicable | Not applicable |

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

The actual GHG emission reductions achieved during this monitoring period are 1.62% higher than the ex-ante estimation. (We consider only the last 280 days from the 366 days of 2012 for this monitoring period for the ex-ante estimation) However, due to the fact that the first 86 days of 2012 are in the dry season, when the production is lower than average, the ex-ante value for this monitoring period is slightly different.

**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**

| 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 $CO_2e$)** | 51304 | 0 |

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[6] Calculated using the PDD estimation for 2012 (66,001 $tCO_2$) times the number of days in this monitoring period (280 days) divided by the number of days of crediting period in 2012, according to the PDD (366 days for 2012).

## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 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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