MONITORING REPORT FORM (F-CDM-MR)
Version 03.2

MONITORING REPORT

Title of the project activity	Malagone SHP CDM Project, Minas Gerais, Brazil (JUN1122)
Reference number of the project activity	4676
Version number of the monitoring report	1
Completion date of the monitoring report	25/03/2014
Registration date of the project activity	15/06/2011
Monitoring period number and duration of this monitoring period	Second monitoring period. 699 days. (01/04/2012 - 28/02/2014)
Project participant(s)	Hidrelétrica Malagone S.A. and Carbotrader Assessoria e Consultoria em Energia Ltda (both Private Entity)
Host Party(ies)	Brazil
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope 1 – Energy Industries (Renewable / Non-renewable Sources) Methodology ACM0002
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	52,761 tCO2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	55,732 tCO2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to December 2012 (if applicable)	22,576 tCO2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable)	33,156 tCO2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The present project activity consists in the electricity generation by renewable sources – hydro potential, through the construction of a Small Hydro Power plant (SHP) called Malagone, developed by the Special Purpose Entity: Hidrelétrica Malagone S.A.

With an installed capacity of 19MW, the SHP is located on the Uberabinha river in the Uberlândia city, Minas Gerais State – south-east region, Brazil.

The electricity delivered to the National Interconnected Grid System (SIN) replaces thermal generation from fossil fuels that would have to be inputted in the system with the generation of a renewable source of energy.

The project activity contributes to the environmental sustainability by increasing the share of renewable energy in relation to the total electricity consumption in Brazil.

Considering that the project activity consists in a SHP with a small reservoir (1.72 km^2) –, it represents a virtually zero environmental impact when compared to large hydroelectric plants. This fact is very important because the construction of Small Hydro Power plants can really contributes to the efficient use of the environmental and natural resources, avoiding the growth of the environmental and social liabilities caused by new large hydroelectric power plants or fossil fuel thermal generation.

In this way, the investment in modern technology for small hydropower plants contributes for an efficient use of the water resources as a relevant factor to be emphasized, adding value to the natural resources.

The technology used in the enterprise is the Uberabinha River (Paranaíba River Basin) hydro energy potential for the electricity generation by the gravitational energy of the water, which is used to move the turbines and by doing this, trigger generators that enable the generation of electricity. This is a source of clean energy and renewable that presents minimal impact on the environment.

The Malagone SHP dispatches generated energy to the National Interconnected Grid (SIN - *Sistema Interligado Nacional*) through the Uberlândia SE Substation – 1 (CEMIG SE-1, which line extension has 34 Km, in 138 KV) located in the Uberlândia city, Minas Gerais state, Brazil. CEMIG is also the local distributor.

The emissions sources and GHGs involved are CO_2 emissions from electricity generation in fossil fuel fired power plants that is displaced due to the project activity and emissions of CH_4 from the reservoir.

The technical characteristics of equipments can be seen in Table 1 below:

Table 1 : SHP technical characteristics

SHP	Malagone
Installed Power (MW)	19
Reservoir (Km^2)	1.72
Assured Generation (MWh)	10.11
Flow Rate River Average (m^3/s)	25
Turbines	Francis

Quantity	2
Power (kW)	9,800
Flow rate (m^3/s)	26.36
Spin (rpm)	400
Generators	
Quantity	2
Nominal Power (kVA)	10,560
Effective Power (MW)	9.5
Voltage (kV)	6.9
Power factor	0.9
Frequency (Hz)	60

The relevant dates for the project activity are registered in the Table 2 below.

Table 2 : SHP Timeline

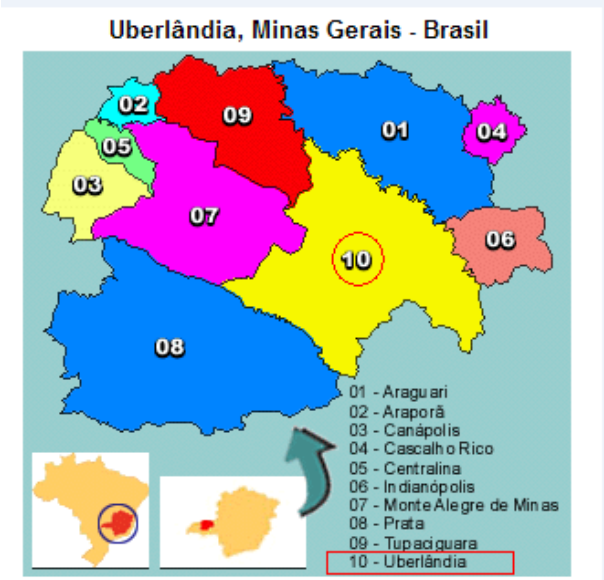
Timeline SHP Malagone	
Start of construction	1st April 2008
Electromechanical installation	30 May 2009
Commissioning of the UG1 and UG2	from 9 to 20 March 2010
Start of Commercial Operation	1st April 2010
Registration date at CIMGC	15 June 2011

The total GHG emission reductions in this monitoring period (01 April 2012 until 28 February 2014) were 55,732 tCO_2.

A.2. Location of project activity

The project activity is located in the Uberabinha River in the municipality of Uberlândia, Minas Gerais State, Brazil. The geographical coordinates of the location of the dam are: 18º 40' 50´´ S and 48º 29´ 57´´ W. The Figure 1 illustrates the location of the enterprise:

Figure 1: Geographical location of Uberlândia city.



Source: Wikipedia - pt.wikipedia.org and City Brazil - www.citybrazil.com.br[1]

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (Host Country)	**Hidrelétrica Malagone S.A** (Private Entity)	No
	Carbotrader Assessoria e Consultoria em Energia Ltda (Private Entity)	

A.4. Reference of applied methodology

The methodology used was the ACM0002: **"Consolidated baseline methodology for grid-connected electricity generation from renewable sources" -** version 11[2] (valid from 26 February 2010 to 16 September 2010).

The methodology tool used to the baseline calculation was the **"Tool to calculate the emission factor for an electricity system"** - version 02[3] (valid from 16 October 2009 to 14 April 2011).

The methodology tool used to the additionality assessment is the **"Tool for the demonstration and assessment of additionality"** - version 05.2[4] (valid from 26 August 2008 onwards).

A.5. Crediting period of project activity

15/06/2011 to 14/06/2018, 7 years, renewable.

[1] City Brasil – Percorrendo o Brasil de A a Z. http://www.citybrazil.com.br

[2] http://cdm.unfccc.int/filestorage/H/G/Y/HGY3TLRFPQVM016WA4I7XCZD92KE5S/EB52_repan07_ACM0002_ver11.pdf?t=eW98bjM3dGdrfDDW1qttU_oDu9IVX99oWc_F

[3] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf

[4] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The technology used in the enterprise is the Uberabinha River (Paranaíba River Basin) hydro energy potential for electricity generation by the gravitational energy of the water, which is used to move the turbines and by doing this, trigger generators that enable electricity generation. This is a source of clean and renewable energy that presents minimal impact on the environment.

The Malagone SHP is a venture classified as Small Hydro Power Plant because according to the Brazilian Resolution no. 652, 09/12/2003, from National Electric Energy Agency (ANEEL), to be considered a SHP the reservoir area must be less than 3 Km^2 (300 ha) and the total installed capacity between 1 MW and 30 MW. The Malagone SHP has 1.72 Km^2 of reservoir area and total installed capacity of the 19 MW, thus this the Power density is 11.04 W/m^2 (in accordance with CDM meth rules). The venture is also called a "run of river" plant which does not include significant water stocks.

The Malagone SHP dispatches generated energy to the National Interconnected Grid (SIN - *Sistema Interligado Nacional*) through the Uberlândia SE Substation – 1 (CEMIG SE-1, which line extension has 34 Km, in 138 KV) located in the Uberlândia city, Minas Gerais state, Brazil. The CEMIG is the local utility for energy distribution.

The technology and equipment used in the project activity were developed and manufactured in Brazil and there was not transferring of know-how or technology to the host country.

The emissions sources and GHGs involved are CO2 emissions from electricity generation in fossil fuel fired power plants that were displaced due to the project activity and emissions of CH_4 from the reservoir.

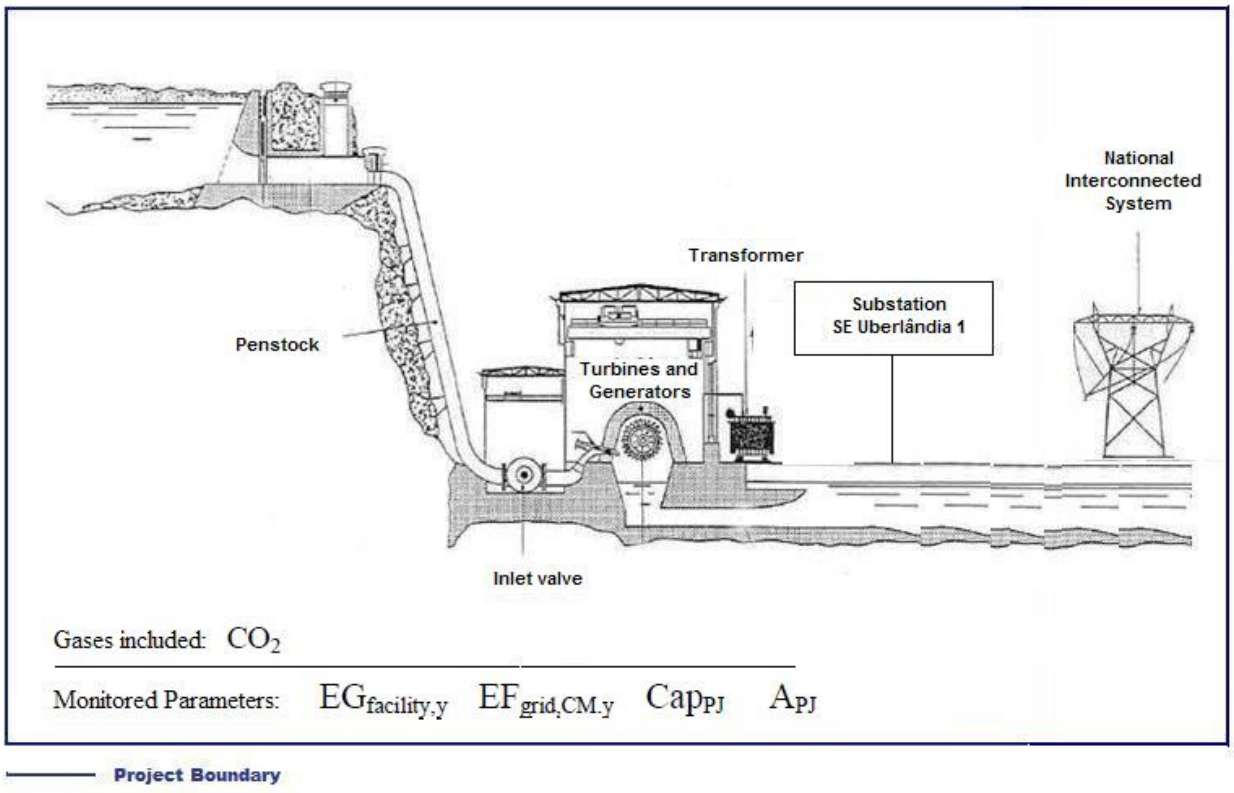
The technical characteristics of equipment that were implemented in SHP can be seen in Table 3 below:

Table 3: SHP technical characteristics

SHP	Malagone
Installed Power (MW)	19
Reservoir (Km^2)	1.72
Assured Generation (MWh)	10.11
Flow Rate River Average (m^3/s)	25
Turbines	Francis
Quantity	2
Power (kW)	9,800
Flow rate (m^3/s)	26.36
Spin (rpm)	400
Generator	
Quantity	2
Nominal Power (kVA)	10,560
Effective Power (MW)	9.5
Voltage (kV)	6.9
Power factor	0.9

Frequency (Hz)	60

The diagram below shows the project boundary, main equipments, monitored parameters and gases included:



The project was implemented according its technical specification. The commissioning was done from 9th to 20th March 2010, and the commercial operation started on 1st April 2010.
There were stops mainly due to hydrological reasons, cleaning the frontal grid (to retire waste accumulated), but these did not cause alterations in the calculations of the project emission reductions.
The crediting period began in 15th June 2011 (with the project registration on the CDM EB). The first monitoring report was done for the period started in 15th June 2011 until 31st March 2012. The second monitoring report has been done from 1st April 2012 until 28th February 2014.

B.2. Post registration changes

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

Not Applicable

B.2.2. Corrections

Not Applicable

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

Not Applicable

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

Not Applicable

B.2.5. Changes to start date of crediting period
Not Applicable

B.2.6. Types of changes specific to afforestation or reforestation project activity
Not Applicable

SECTION C. Description of monitoring system
The measurement system does the measure and records the value of the energy. For SHP Malagone measurement system was installed a panel containing two meters (a main and one back-up). This panel measurement is exclusive for the SHP Malagone and is located in Uberlandia substation from CEMIG (Companhia Energetica de Minas Gerais - the local energy utility). The measurement system measures and records the energy, and for this system is guaranteed the inviolability of the data, which is sealed for safety after the calibration.

The complete Monitoring and Measurement System, called SMF, consists of a meter panel and a satellite-link to communicate and send the data to CCEE and Malagone. SMF energy measurement includes the already said panel with a principal and a back-up meter (back-up meter). If there is a problem with the principal meter, the back-up meter automatically continues the measurement of energy, without any discontinuity. If, besides the main meter have a problem, the back-up meter have some problem too, it will be used the methodology to estimate data as the item 14.3 of the Procedure of Energy Commercialization PdC ME.01, version 4, that states a priority order for procedures:
Initially, if the problem had been happened for one hour only, to use an average between the immediate prior and posterior measures. Secondly if available, measurement meter conference ("check meter"), the third option is, for measure of net generation, consider the measuring gross generation adjusted, e.g. considering estimates of domestic consumption and / or losses. To see the subsequent options verify the Procedure.

Both the measurement data (CCEE and Malagone) comes from the same meters, the main one with serial number PT-0902A505-01, or the back-up with serial number PT-0902A177-01, in case of fail of the main meter.

The CCEE reads the data through a GPRS system and the software: Sinercom. The same data is send to Malagone through the CAS system and the software Hemera Technology Platform.

To an easier understanding, see the figure 2 below.

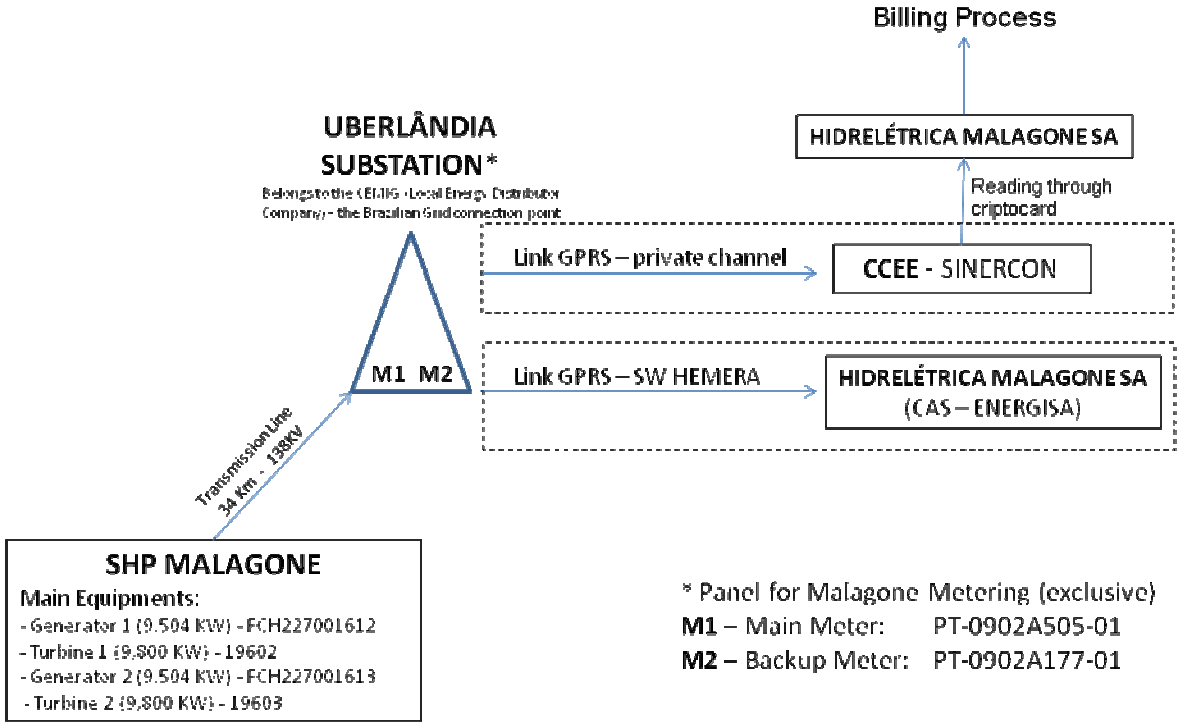


Figure 2: Flow chart of energy and generation data.

The procedures designed for monitoring electricity generation by the project activity follows the parameters and rules of the Brazilian energy sector. The National Grid Operator (ONS) and the Electric Power Commercialization Chamber (CCEE) are the entities responsible for specification of the technical requirements of energy measurement system for billing.

Data monitoring:

The meter readings are used to calculate the emission reductions. The monitoring steps are as follows:

(1) The data will be measured hourly and recorded monthly;
(2) Spreadsheets containing the electricity dispatched to the grid are generated; CCEE data measured (from CCEE databank – SINERCON) are used to calculate the emissions reductions and, if necessary, sales receipts will be used to cross check the monitored data;
(3) The Malagone provides to Carbotrader their recorded datas from the meters, CCEE datas and, when necessary, copies of energy bills.
(4) The emissions reductions are managed by the project manager responsible at Carbotrader;

Details regarding the parameter to be monitored can be founded in the section D.2.

Quality control:

(1) Calibration of meters
The calibration of meters is conducted by a qualified organization that complies with national standards and industrial regulations to ensure the accuracy. After calibration, the meters are sealed for safety and the calibration certificates are archived with the monitoring datas.
In the generation energy values from 20/07/2013 and 09/10/2013 (inclusive) were discounted the imprecision of the meters (0.2%), since the calibration did not cover this period. It can be seen in the document annexed "CERs 2nd MR.xls"(Tabs July 13, August 13, September 13 and October 13).

As described in the EB 52 annex 60, paragraph 4, the option applied was the "a" one because the errors from calibration were smaller than the maximum permissible error. Then, as the results of delayed calibration contain errors smaller than maximum permissible errors in measuring equipments, in the values from 20/07/2013 to 09/10/2013, were discounted the imprecision of the meter (0.2%). .
See below the Table 4 with the calibration datas:

Nº	METERS IDENTIFICATION		NUMBER OF CALIBRATION CERTIFICATE	DATE OF ISSUE	VALIDITY
1	Serie number: PT-0902A505-01 Manufacturer: Schneider Electric	Main meter	Report N^{o} 003/2009	08/06/2009	08/06/2011
2	Serie number: PT-0902A177-01 Manufacturer: Schneider Electric	Back-up meter	Report N^{o} 003/2009	08/06/2009	08/06/2011
3	Serie number: PT-0902A505-01 Manufacturer: Schneider Electric	Main meter	CC-0127-11	20/07/2011	20/07/2013
4	Serie number: PT-0902A177-01 Manufacturer: Schneider Electric	Back-up meter	CC-0128-11	20/07/2011	20/07/2013
5	Serie number: PT-0902A505-01 Manufacturer: Schneider Electric	Main meter	CC-0176-13	09/10/2013	09/10/2015
6	Serie number: PT-0902A177-01 Manufacturer: Schneider Electric	Back-up meter	CC-0175-13	09/10/2013	09/10/2015

Table 4: Calibration datas

(2) Emergency treatment
In case of unavailability of measures from any point of measurement, due to maintenance, commissioning or for any other reason, will be used the methodology to estimate data as the item 14.3 of the Procedure of Energy Commercialization PdC ME.01, version 4, that states that:
As the first option, to use the back-up measure. Second option, if the measure lost is only one hour, to use an average between the immediate prior and posterior measures. To see the subsequent options verify the Procedure.

Data Management:

All data gathered in the monitoring range will be electronically filed and kept for at least 2 years after the last crediting period. The crediting to be generated will be calculated regularly by the project proponents and kept for the verification phase.

Procedures:

The procedures are the described in the ONS site – "Module 12: Measurement for billing", as well as in sub-modules:

12.1 - Billing Measurement: An Overview,
12.2 - Installation of the measuring system for billing,
12.3 - Maintenance of the measurement system for billing,
12.4 - Collection of metering data for billing,
12.5 - Certification of labor standards,
12.6 - Settings for measuring revenue.

These procedures are available in http://www.ons.org.br/procedimentos/modulo_12.aspx, and are being followed by the agents responsible for the generation of the SHP Malagone. Thus, here are defined procedures for collection of data generation, frequency calibration of the measuring system, equipment accuracy class of the measuring system, etc.

Authority and Responsibility

The Hidrelétrica Malagone S.A is responsible for the maintenance and calibration of the monitoring equipments, compliance to operational requirements and corrective actions related to the functionality of the project activity. Moreover, the company has authority and responsibility for registration, monitoring, and measurement as well as managing the project, to organize staff training to use appropriated techniques in those procedures.

The Baseline and Emissions Reductions calculations were performed by Carbotrader Assessoria e Consultoria em Energia Ltda which reported the results in a proper way to the entities related with the CDM process.

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

Data/Parameter	Cap_{PJ}
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	Project site
Value(s) applied	0
Purpose of data	Calculation of the project emissions.
Additional comment	

Data/Parameter	A_{PJ}
Unit	m^2
Description	Area of the reservoir measured in the water 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	Project site
Value(s) applied	0
Purpose of data	Calculation of the project emissions.
Additional comment	

D.2. Data and parameters monitored

Data/Parameter	$EG_{facility,2012}$
Unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year 2012.
Measured/Calculated /Default	Measured
Source of data	Project site - Energy Meters
Value(s) of monitored parameter	57,389,084.19
Monitoring equipment	2 meters (main and back-up), Type: ION-8600, Manufacturer: Schneider Electric, accuracy class 0.2; Serial number: PT-0902A505-01 and PT-0902A177-01; calibration frequency: each 2 years; Last calibration: 9 October 2013; validity: 9 October 2015.
Measuring/Reading/ Recording frequency	Hourly measurement and reading and monthly recording.
Calculation method (if applicable)	-
QA/QC procedures	These data will be used for calculate the emission reductions. The data will be archived monthly (electronic) and will be archived during the credit period and two years after. The data from the energy meters will be cross checked with the CCEE databank in order to verify the coherency of the data.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,CM,2012}$
Unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year *2012*
Measured/Calculated /Default	Calculated
Source of data	Based on data provided by the DNA (Designated National Authority).
Value(s) of monitored parameter	0.3934
Monitoring equipment	-
Measuring/Reading/ Recording frequency	Annually
Calculation method (if applicable)	The Combined Margin is calculated through a weighted-average formula, considering the $EF_{grid,OM-DD,y}$ and the $EF_{grid,BM,y}$ and the weights w_{OM} and w_{BM} default 0.5. as defined in the "Tool to calculate the emission factor for an electricity system", version 02.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,OM\text{-}DD,2012}$
Unit	tCO_2/MWh
Description	CO_2 Operating Margin emission factor of the grid, in a year *2012*
Measured/Calculated /Default	Calculated
Source of data	Data provided by the DNA (Designated National Authority) monthly
Value(s) of monitored parameter	0.5858
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Monthly
Calculation method (if applicable)	As defined in the "Tool to calculate the emission factor for an electricity system"
QA/QC procedures	This data, updated, will be applied in *ex-post* calculation of the Emission Factor.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,BM,2012}$
Unit	tCO_2/MWh
Description	CO_2 Build Margin emission factor of the grid, in a year *2012*
Measured/Calculated /Default	Default
Source of data	Data provided by DNA (Designated National Authority) to the year *y*.
Value(s) of monitored parameter	0.2010
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annual
Calculation method (if applicable)	As defined in the "Tool to calculate the emission factor for an electricity system"
QA/QC procedures	This data, updated, will be applied in *ex-post* for the calculation of the Emission Factor.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EG_{facility,2013}$
Unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year 2013
Measured/Calculated /Default	Measured
Source of data	Project site - Energy Meters
Value(s) of monitored parameter	85,597,893.55
Monitoring equipment	2 meters (main and back-up), Type: ION-8600, Manufacturer: Schneider Electric, accuracy class 0.2; Serial number: PT-0902A505-01 and PT-0902A177-01; calibration frequency: each 2 years; Last calibration: 9 October 2013; validity: 9 October 2015.
Measuring/Reading/ Recording frequency	Hourly measurement and reading and monthly recording.
Calculation method (if applicable)	-
QA/QC procedures	These data will be used for calculate the emission reductions. The data will be archived monthly (electronic) and will be archived during the credit period and two years after. The data from the energy meters will be cross checked with the CCEE databank in order to verify the coherency of the data.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,CM,2012}$
Unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year *2012*
Measured/Calculated /Default	Calculated
Source of data	Based on data provided by the DNA (Designated National Authority).
Value(s) of monitored parameter	0.3548
Monitoring equipment	-
Measuring/Reading/ Recording frequency	Annually
Calculation method (if applicable)	The Combined Margin is calculated through a weighted-average formula, considering the $EF_{grid,OM-DD,y}$ and the $EF_{grid,BM,y}$ and the weights w_{OM} and w_{BM} default 0.5. as defined in the "Tool to calculate the emission factor for an electricity system", version 02.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,OM-DD,2012}$
Unit	tCO_2/MWh
Description	CO_2 Operating Margin emission factor of the grid, in a year *2012*
Measured/Calculated /Default	Calculated
Source of data	Data provided by the DNA (Designated National Authority) monthly
Value(s) of monitored parameter	0.5086
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Monthly
Calculation method (if applicable)	As defined in the "Tool to calculate the emission factor for an electricity system"
QA/QC procedures	This data, updated, will be applied in *ex-post* calculation of the Emission Factor.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,BM,2012}$
Unit	tCO_2/MWh
Description	CO_2 Build Margin emission factor of the grid, in a year *2012*
Measured/Calculated /Default	Default
Source of data	Data provided by DNA (Designated National Authority) to the year *y*.
Value(s) of monitored parameter	0.2010
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annual
Calculation method (if applicable)	As defined in the "Tool to calculate the emission factor for an electricity system"
QA/QC procedures	This data, updated, will be applied in *ex-post* for the calculation of the Emission Factor.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EG_{facility,2014}$
Unit	MWh/year
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year 2013
Measured/Calculated /Default	Measured
Source of data	Project site - Energy Meters
Value(s) of monitored parameter	10,894,036.27
Monitoring equipment	2 meters (main and back-up), Type: ION-8600, Manufacturer: Schneider Electric, accuracy class 0.2; Serial number: PT-0902A505-01 and PT-0902A177-01; calibration frequency: each 2 years; Last calibration: 9 October 2013; validity: 9 October 2015.
Measuring/Reading/ Recording frequency	Hourly measurement and reading and monthly recording.
Calculation method (if applicable)	-
QA/QC procedures	These data will be used for calculate the emission reductions. The data will be archived monthly (electronic) and will be archived during the credit period and two years after. The data from the energy meters will be cross checked with the CCEE databank in order to verify the coherency of the data.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,CM,2012}$
Unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year *2012*
Measured/Calculated /Default	Calculated
Source of data	Based on data provided by the DNA (Designated National Authority).
Value(s) of monitored parameter	0.2558
Monitoring equipment	-
Measuring/Reading/ Recording frequency	Annually
Calculation method (if applicable)	The Combined Margin is calculated through a weighted-average formula, considering the $EF_{grid,OM-DD,y}$ and the $EF_{grid,BM,y}$ and the weights w_{OM} and w_{BM} default 0.5. as defined in the "Tool to calculate the emission factor for an electricity system", version 02.
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,OM-DD,2012}$
Unit	tCO_2/MWh
Description	CO_2 Operating Margin emission factor of the grid, in a year *2012*
Measured/Calculated /Default	Calculated
Source of data	Data provided by the DNA (Designated National Authority) monthly
Value(s) of monitored parameter	0.3107
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Monthly
Calculation method (if applicable)	As defined in the "Tool to calculate the emission factor for an electricity system"
QA/QC procedures	This data, updated, will be applied in *ex-post* calculation of the Emission Factor.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data/Parameter	$EF_{grid,BM,2012}$
Unit	tCO_2/MWh
Description	CO_2 Build Margin emission factor of the grid, in a year *2012*
Measured/Calculated /Default	Default
Source of data	Data provided by DNA (Designated National Authority) to the year *y*.
Value(s) of monitored parameter	0.2010
Monitoring equipment	Not applicable.
Measuring/Reading/ Recording frequency	Annual
Calculation method (if applicable)	As defined in the "Tool to calculate the emission factor for an electricity system"
QA/QC procedures	This data, updated, will be applied in *ex-post* for the calculation of the Emission Factor.
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.
Source of data	Project site
Value(s) applied	19,000,000
Purpose of data	Calculation of the project emissions.
Additional comment	In Brazil, the installed capacity of hydropower plants is determined and authorized by the competent regulatory agency. Furthermore, any modification must be authorized and made public available. Thus, annually, any new authorization to increase the installed capacity of plan is monitored.

Data/Parameter	A_{PJ}
Unit	m^2
Description	Area of the reservoir measured in the water surface, after the implementation of the project activity, when the reservoir is full.
Source of data	Project site
Value(s) applied	1,717,174
Purpose of data	Calculation of the 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

The baseline methodology considers the determination of the emissions factor to the grid which the project activity is connected as the core data to be determined in the baseline scenario. In Brazil, the grid is interconnected by the National Interconnected System (SIN) in a single system[5].

"Operating Margin *OM* Emission Factor" calculation ($EF_{grid,OM-DD,y}$)

The calculation of the $EF_{grid,OM-DD,y}$ was done using the form and datas below. The $EF_{grid,OM-DD,y}$ is published by the Brazilian DNA monthly and is available in its website[6].

$$EF_{grid,OM-DD,y} = \frac{\sum_{m} EG_{PJ,y} \cdot EF_{OM,DD,y}}{EG_{PJ,y}}$$

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/year);

The calculation of the $EF_{grid,OM-DD,y}$ was done using the form above and the datas from the document "CERs 2nd MR.xls", tabs "Hourly 2012", "Hourly 2013" and "Hourly 2014".

As a summary, the $EF_{grid,OM-DD,y}$ is published by the Brazilian DNA monthly.

2012 SHP Malagone Power Generation (MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
			10.870,43	8.362,93	7.286,83	5.592,75	4.221,45	3.429,68	3.891,89	7.077,52	6.655,60

EF_{OM} 2012 (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0,2935	0,3218	0,4050	0,6236	0,5943	0,5056	0,3942	0,4490	0,6433	0,6573	0,6641	0,6597

[5] http://www.mct.gov.br/upd_blob/0024/24834.pdf
[6] http://www.mct.gov.br/index.php/content/view/333605.html#ancora

2013 SHP Malagone Power Generation (MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
8.840,76	9.167,68	11.046,20	10.394,26	6.499,59	6.374,39	4.906,60	3.368,78	3.147,60	5.554,94	6.290,17	10.006,93

EF_{OM} 2012 (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0,2935	0,3218	0,4050	0,6236	0,5943	0,5056	0,3942	0,4490	0,6433	0,6573	0,6641	0,6597

2014 SHP Malagone Power Generation (MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
6.550,91	4.343,12										

EF_{OM} 2012 (tCO_2/MWh)

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0,2935	0,3218	0,4050	0,6236	0,5943	0,5056	0,3942	0,4490	0,6433	0,6573	0,6641	0,6597

"Building Margin *BM* Emission Factor" ($EF_{grid,BM,y}$)

The $EF_{grid,BM,y}$ is published by the Brazilian DNA annually and it is available in its website[7]. The last available data is for 2012 year.

$EF_{grid,BM,y} = 0.2010$ tCO_2/MWh

"Baseline Emission Factor" calculation ($EF_{grid,CM,y}$)

The baseline emission factor ($EF_{grid,CM,y}$) is calculated through a weighted-average formula, considering both the $EF_{OM,,y}$ and the $EF_{BM,,y}$ weighted 50% each, by definition, that gives:

$$EF_{grid,CM,y} = EF_{grid,OM\text{-}DD,y} * 0{,}5 + EF_{grid,BM,y} * 0{,}5 \ (tCO_2/MWh)$$

To 2012, SHP Power Generation (MWh)

$EF_{grid,CM,y} = 0.5858 * 0.5 + 0.2010 * 0.5$

$EF_{grid,CM,y} = 0.3934$ tCO_2/MWh

To 2013, SHP Power Generation (MWh)

$EF_{grid,CM,y} = 0.5086 * 0.5 + 0.2010 * 0.5$

$EF_{grid,CM,y} = 0.3548$ tCO_2/MWh

To 2014, SHP Power Generation (MWh)

$EF_{grid,CM,y} = 0.3107 * 0.5 + 0.2010 * 0.5$

$EF_{grid,CM,y} = 0.2558$ tCO_2/MWh

[7] http://www.mct.gov.br/index.php/content/view/74689.html

Emission Reduction

The emission reduction values are presented below, in tCO_2. They are the product of the baseline emissions factor ($EF_{grid,CM,y}$ in tCO_2/MWh) multiplied by the electricity supplied by the project activity to the grid ($EG_{PJ,m}$ in MWh) by month, as follows:

$$ER_y = EF_{grid,CM,y} * EG_{PJ,y}$$

Where:

ER_y = Emission reduction in month m (tCO_2);

$EF_{grid,CM,y}$ = Combined margin CO2 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" (tCO2/MWh).

$EG_{PJ,y}$ = 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 month m (MWh/month);

Then:
$ER_y = EF_{grid,CM,y} * EG_{PJ,y}$

For 2012:
$ER_{2012} = 0.3934 * 57,389,084.19$
$ER_{2012} = 22,576\ tCO_2$

For 2013:
$ER_{2013} = 0.3548 * 85,597,893.55$
$ER_{2013} = 30,370\ tCO_2$

For 2014:
$ER_{2014} = 0.2558 * 10,894,036.27$
$ER_{2014} = 2,786\ tCO_2$

Baseline Emissions

Baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor ($EF_{grid,CM,y}$ in tCO_2/MWh) multiplied by the electricity supplied by the project activity to the grid ($EG_{PJ,y}$ in MWh), as follows:

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

Where:

BE_y = Baseline emissions in year y (tCO_2e/year);

$EF_{grid,CM,y}$ = Combined margin CO2 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" (tCO2/MWh).

$EG_{PJ,y}$ = 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/year);

For 2012:
$BE_{2012} = 0.3934 * 57,389,084.19$
$BE_{2012} = 22,576\ tCO_2$

For 2013:

BE_{2013}= 0.3548 * 85,597,893.55
BE_{2013}= 30,370 tCO_2

For 2014:
BE_{2014}= 0.2558 * 10,894,036.27
BE_{2014}= 2,786 tCO_2

E.2. Calculation of project emissions or actual net GHG removals by sinks
The power density of the project activity is calculated as stated in the ACM0002: **"Consolidated baseline methodology for grid-connected electricity generation from renewable sources" - version 11, that** follows below:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

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.

$$PD = \frac{19{,}000{,}000 - 0}{1{,}717{,}174 - 0} = 11.06 \text{ W/m}^2$$

As the Power Density of the project activity is greater than $10W/m^2$, then Project Emissions (PE) are zero.

As stated in the version 11 of ACM0002, the Emission Reductions are calculated by the form below:

$ER_y = BE_y - PE_y$

Where:
ER_y = Emission reductions in year *y* (t CO_2e/yr)
BE_y = Baseline emissions in year *y* (t CO_2/yr)
PE_y = Project emissions in year *y* (t CO_2e/yr)

Then,
ER = (ER_{2012}+ ER_{2013} + ER_{2014}) - 0
ER = (22,576 + 30,370 + 2,786)- 0 = 55,732 t CO_2e

That is ER total of the period.

E.3. Calculation of leakage
There is no leakage associated with this project activity.

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

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)	Project emissions or actual net GHG removals by sinks (tCO_{2e})	Leakage (tCO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)
Total	55,732	0	0	55,732

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

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO_2e)	52,761	55,732

The value for the estimated emission reduction in this table increased 5.6% over the second monitoring period.

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

As the Emission Factor measured was 16,1% greater than the emission factor *ex-ante* estimated and the net electricity generation measured was 9,3% less than the *ex-ante* estimated has occurred this difference between the *ex-ante* estimated versus actual values.[8]

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 (tCO_2e)	22,576	33,156

- - - - -

[8] Calculated is demonstrated in the document "CERs JUN1122_v2 AND CALCULATION.xls".

Document information

Version	*Date*	*Description*
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 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.
Decision Class: Regulatory Document Type: Form Business Function: issuance Keywords: monitoring report, performance monitoring		