MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

CONTENTS

* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

MONITORING REPORT
Version 1 - 21/09/2011

Paraíso Small Hydropower Plant - PCH Paraíso
Reference number: 1317
Second Monitoring Period - 01/01/2009 - 31/12/2010

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

Although 75% of the electricity generated in Brazil comes from hydroelectric plants, the necessity to expand country's energy supply, in order to sustain the economic growth achieved in the past few years, has lead to a larger participation of thermo power generation in Brazilian electricity matrix. Nowadays, 15% of the energy consumed in the country is generated by thermoelectric plants and, according to ANEEL (Decennial Plan of Energy Expansion – PDE 2020), by 2014, this percentage will rise to 19%.
Aiming to supply country's great demands for energy in a renewable way, this project consists in the installation of a small hydropower plant (PCH Paraíso) of 21.6 MW installed capacity and a reservoir of 1,2 Km² in river Paraíso. Thus, PCH Paraíso will contribute to the overall reduction of CO_2 emissions in Brazil, thereby helping the country to meet the reduction goes stipulated by the National Plan on Climate Change (PNMC).
The relevant dates for the project activities are:
Beginning of the construction:
Commissioning:
Beginning of the commercial operation: unit 1 March 13th, 2003 and unit 2 April, 12th, 2003
In the second period of monitoring, 48,523tCO_2 were reduced form the baseline.

A.2. Project Participants

Nome of Party involved	Private and/or public entity(ies) project participants	Kindly indicate if the Party involved whishes to be considered as project participant
Brazil (host country)	Energias do Brasil S/A	No

A.3. Location of the project activity:

SHP Paraíso is located in the river Paraíso, in the Brazilian state of Mato Grosso do Sul, between Costa Rica and Chapadão do Sul municipalities. The geographical coordinates are 19º03' South and 52º59' West.

A.4. Technical description of the project

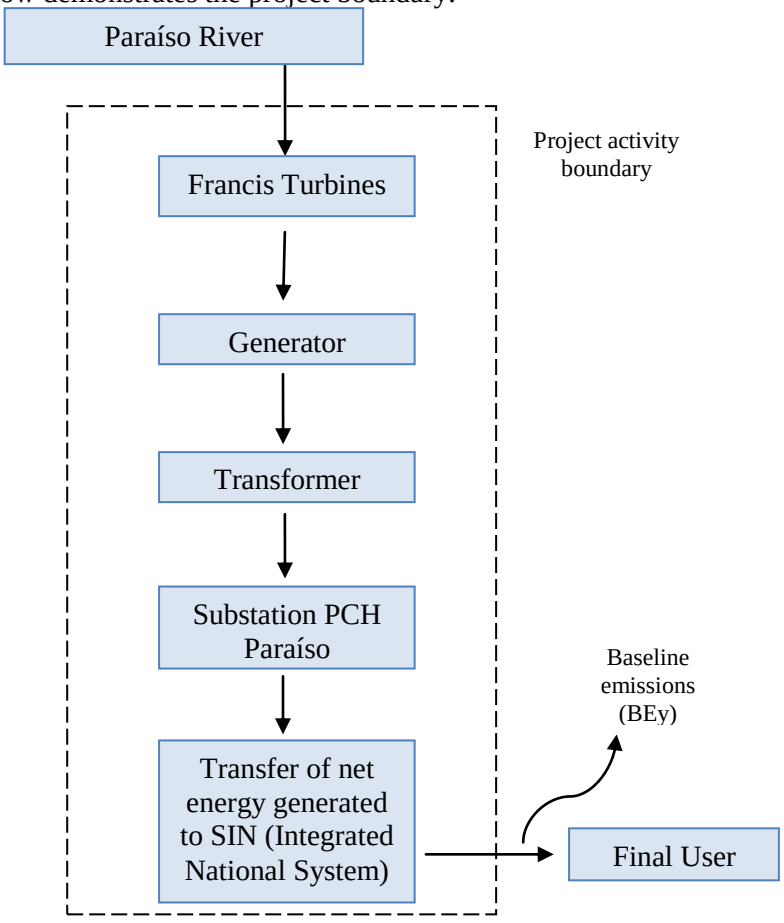
This project aims to generate electricity by exploiting the hydroelectric potential of the Paraíso River. To this end, a small hydroelectric plant (PCH Paraíso), with installed capacity of 21.6 MW, and integrated into the National Integrated System, was built. It is noteworthy that only the net energy (given by the following formula: gross energy – internal consumption of the plant) produced by PCH is redirected to the SIN. More information about the technical aspects of PCH Paraíso is available in the table below.

Small Hydro Power Plant - PCH Paraíso		
Turbines		
	Turbine 1	Turbine 2
Voith Siemens	Voith Siemens	Voith Siemens
Type	Horizontal Francis	Horizontal Francis
Serial Number	18990	18991
Nominal Capacity	10.8 MW	10.8 MW
Generators		
	Generator 1	Generator 2

Unit Nominal Capacity (kVA)	12.000	12.000
Power Factor	0.9	0.9
Meters		
	Meter 1	Meter 2
Itron	Itron	Itron
Model	Q1000	Q1001
Serial Number	42104068	42104067
Voltage	115	115

The technology employed at PCH Paraíso Project is a well known established technology in the industry. A low-level diversion dam raises the water level in the river sufficiently to enable an intake structure to be located on the side of the river. The intake consists of a trash screen and a submerged opening with an intake gate. Water from the intake is normally taken through a pipe (called a penstock) downhill to a power station constructed downstream of the intake and at as low a level as possible to gain the maximum head on the turbine.
The Francis turbine is the most widely used among water turbines. This turbine is a type of hydraulic reactor turbine in which the water flow exists the turbine blades in the radial direction. Francis turbines are common in power generation and are used in applications where high glow rates are available at medium hydraulic head. Water enters the turbine through a volute casing and is directed onto the blades by wicket gates. The low momentum water then exists the turbine through a draft tube. In the model, water flow is supplied by a variable speed centrifugal pump. A load is applied to the turbine by means of a magnetic brake, and torque is measured by observing the deflection of calibrated springs. The performance is calculated by comparing the output to the energy supplied. A run-of-river project presents low environmental impact.

The chart below demonstrates the project boundary:



A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

Approved and consolidated baseline ACM0002 – version 6 – May 19th, 2006. "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

A.6. Registration date of the project activity:

SHP Paraíso's PDD was registered in February 11th, 2008.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

The crediting period goes from February 11th, 2008 to February 10th, 2018.

A.8. Name of responsible person(s)/entity(ies):

Responsible person for the documentation development (technical consulting): Mr. Ernesto Cavasin, PriceWaterhouseCoopers - Brazil
Address: Avenida Francisco Matarazzo, 1400 - Torre Torino, Barra Funda
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SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

There were no events or situations identified during this monitoring period which may impact the applicability of the methodology.

B.2. Revision of the monitoring plan

N/A

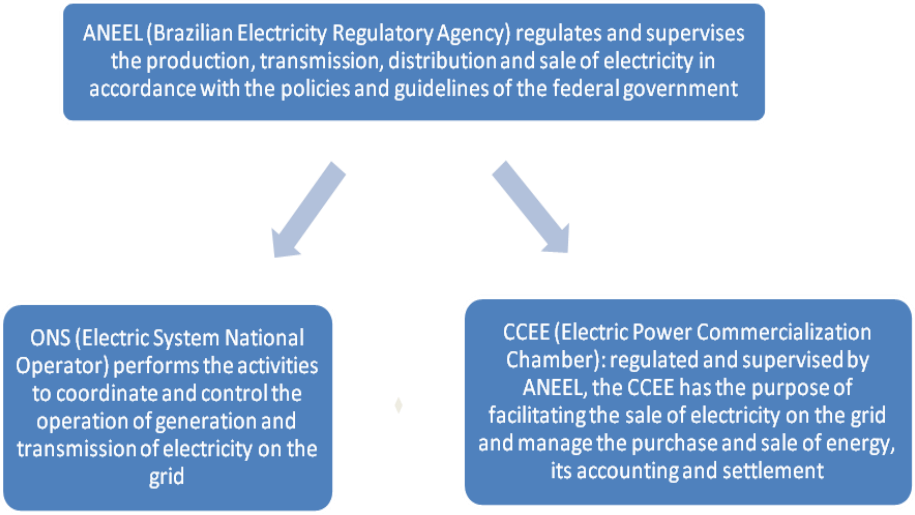
B.3. Request for deviation applied to this monitoring period

N/A

B.4. Notification or request of approval of changes

N/A

SECTION C. Description of the monitoring system



The CCEE, together with the ONS, is responsible for specify, guide and establish all the issues related to the adequacy of the SFM (Sistema de Adequação e Faturamento). It is as well responsible to the operation and maintenance of the SCDE (Sistema de Coleta de Dados de Energia), in such a way that the collection of data regarding electric energy can be available to be used by the SCL (Sistema de Contabilização e Liquidação).
In order to calculate the emission reductions of the Project activity the generated energy that is going to be delivered to the grid (EG_y) is constantly monitored. This monitoring process is planned and carried out according to the Grid Procedures[1] established by the ONS, which are divided in 26 modules and can be easily find on the internet (Procedimentos de Rede http://extranet.ons.org.br/operacao/prdocme.nsf/principalPRedeweb?openframeset). These procedures are jointly implemented by the agents and the CCEE.
SMF is a system that embraces the main and the backup meters, the instrument's transformers (TI) – potential and electrical current transformers –, the means of communication used by the agents and the CCEE, and the systems of data collection for billing.

	Main meter	**Backup meter**
Model	Q1000	Q1000
Manufacturer	Itron	Itron
Serial number	42101067	42104068
Calibration date		03/11/2008 20/05/2009

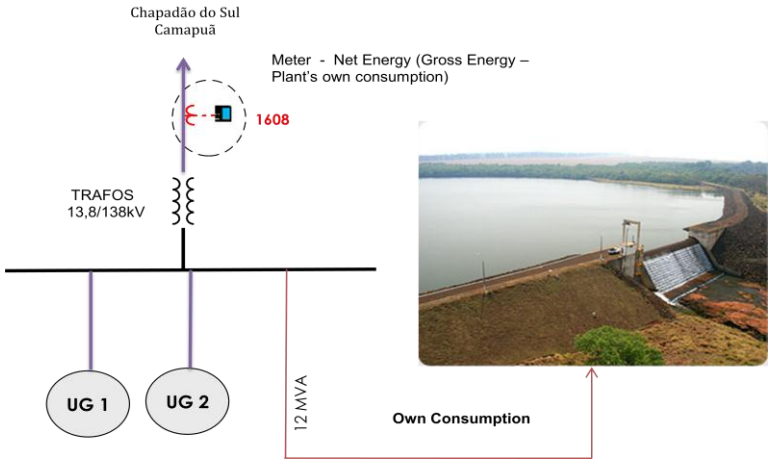
Both, the main and the backup meters, are located in the substation of PCH Paraíso, beside the plant. This equipments, are calibrate every 24 months (two years), following, thus, the recommendations of the ONS. The calibration pattern used by the measurement agent is given by the INMETRO, as is required for the Grid Procedures mentioned above. In order to control the data concerning the energy generation, the meters are compared against each other every month.

The data stored by the meters is remote and automatically collected by CCEE's SCDE. This procedure can happen directly, when the SCDE has direct access to the meters beyond the agents responsibility; or indirectly (passively), through agent's Unit of Collection and Measurement (UCM), which collects the data from the meters, convert it in XLM archives, according to CCEE specifications, and make it daily available for being collect by the SCDE during the interval established by the CCEE.

[1] Grid Procedures (Procedimentos de Rede) are normative documents developed by the ONS, together with the agents and approved by the ANEEL, that define the procedures and requirements needed to perform the activities of energetic operation planning, transmission management, programming and real-time operation under the SIN.

In order to pursue the data collection directly, the measurement agent must have an exclusive gateway (given by the CCEE) that make possible to the Chamber's center of data collection having remote access to the meters at anytime. Thus, the Chamber can collect and consolidate data every five full minutes during the day.
Through the indirect (passive) collection, the CCEE receives and stores, by SCDE, the data from the meters, which also is collected from five to five full minutes and daily sent to CCEE by the agent responsible for the SMF. The measurement data obtained by the meters is electronically archived and compared against the CCEE's controls.
The meters register the measurement of the last 35 days and the data remain stored on the device.
This data are also stored in the ION Enterprise software, which records the readings and make them available to users. The analysis of the data concerning the energy generation is made by the Department of Market Studies and registered in the datacenter of the measurement agent.

The figure below demonstrates the meters localization and the energy flow at PCH Paraíso:



SECTION D. Data and parameters

The monitoring plan is based on the approved monitoring methodology ACM0002, version 6, which is applicable to grid-connected renewable power generation project activities such as electricity capacity additions from existing hydro power projects with existing reservoirs where the volume of the reservoir is not increased.
The monitoring period considered in this verification comprises the period from 01/01/2009 to 31/12/2010.
The **EG_y** (MWh) parameter is applied for the monitoring. It represents the electricity generation delivered to grid and is registered **monthly** by the Measurement Department of *Pantanal.*
The emission factor (EF_y) is calculated based on the combined margin approach, which depends on the operating (EF_{OMy}) and build (EF_{BMy}) margin value. The EF_y is calculated ex-post, according to the PDD.

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors	
Data / Parameter:	**EF_y**
Data unit:	**tCO_2e/MWh**
Description:	Emission Factor
Source of data used:	Data obtained from MCT (www.mct.gov.br) and calculated according to ACM0002 (version 6) methodology.
Value(s) :	2009: 0.1635 2010: 0.3095
Indicate what the data are	Baseline emission calculation

used for (Baseline/ Project/ Leakage emission calculations)	
Additional comment:	The baseline emission factor (EFy) is calculated as the weighted average of the combination of operating margin (OM) and build margin (BM) factors.

Data / Parameter:	**$EF_{OM, y}$**
Data unit:	**tCO_2e/MWh**
Description:	Emission Factor - CO_2 Operating Margin emission factor of the grid
Source of data used:	Data obtained from MCT (www.mct.gov.br) and calculated according to ACM0002 (version 6) methodology.
Value(s) :	2009: 0.2476 2010: 0.4787
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	Mandatory under methodology ACM0002

Data / Parameter:	**$EF_{BM, y}$**
Data unit:	**tCO_2e/MWh**
Description:	Emission Factor - CO_2 Building Margin emission factor of the grid
Source of data used:	Data obtained from MCT (www.mct.gov.br) and calculated according to ACM0002 (version 6) methodology.
Value(s) :	2009: 0.0794 2010: 0.1404
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Additional comment:	Mandatory under methodology ACM0002 and calculated ex-post

D.2. Data and parameters monitored	
Data / Parameter:	**EG_y**
Data unit:	**MWh**
Description:	Electricity supplied to the grid by the project
Measured /Calculated /Default:	48,523
Source of data:	Measured by project developer and monitored by ONS
Value(s) of monitored parameter:	2009: 99,001 2010: 104,474
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emissions calculation

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<table><tr><th></th><th>Main meter</th><th>Backup meter</th></tr><tr><td>Model</td><td>Q1000</td><td>Q1000</td></tr><tr><td>Manufacturer</td><td>Itron</td><td>Itron</td></tr><tr><td>Serial number</td><td>42101067</td><td>42104068</td></tr><tr><td>Calibration date</td><td></td><td>03/11/2008 20/05/2009</td></tr></table> The meters are calibrate every 24 months (two years), following the recommendations of the ONS. The calibration pattern used by the measurement agent is given by the INMETRO, as is required for ONS' Grid Procedures
Measuring/ Reading/ Recording frequency:	Monthly recorded and electronically stored.
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Cross check of the meters with ONS system

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

In accordance with the ACM0002, emission reductions are calculated according to the following formula:

$BE_y = EG_y * EF_y$

Where:

BE_y = baseline emissions in year y;

EG_y = energy generated in year y;

EF_y = emission factor for the year y.

EF_y was calculated ex post for the years 2009 and 2010 using the following formula: $EF_{CM} = (EF_{OM}*W_{OM}) + (EF_{BM}*W_{BM})$.

$EF_{OM,2009}$, according to MCT:

Operating Margin (EF_{OM})	January	February	March	April	May	June	
	0.2813	0.2531	0.2639	0.2451	0.4051	0.3664	
	July	August	September	October	November	December	Average
	0.2407	0.1988	0.1622	0.1792	0.1810	0.1940	0.2476

$EF_{BM,2009}$, according to MCT:

Buid Margin (EF_{BM})	2009
	0.0794

$W_{OM, BM}$, according to ACM0002 methodology:

Peso	Default
(W_{om}/W_{bm})	0.5

$EF_{CM, 2009}$ = (0.2476*0.5) + (0.0794*0.5) = 0.1237 + 0.0817 = **0.1635**

$EF_{OM,2010}$, according to MCT:

Operating Margin (EF_{OM})	January	February	March	April	May	June	
	0.2111	0.2798	0.2428	0.2379	0.3405	0.4809	
	July	**August**	**September**	**October**	**November**	**December**	**Average**
	0.4347	0.6848	0.7306	0.7320	0.7341	0.6348	0.4787

$EF_{BM,2010}$, according to MCT:

	2010
Buid Margin (EF_{BM})	0.1404

$W_{OM, BM}$, according to ACM0002 methodology:

Weight	Default
(W_{om}/W_{bm})	0.5

$EF_{CM, 2010}$ = (0.4787*0.5) + (0.1404*0.5) = 0.2393 + 0.0702 = **0.3095**

The data concerning EG_y was obtained through the meters installed at PCH Paraíso substation:

2009	EG_y (MWh)
January	9241.337
February	10,161.494
March	11,579.355
April	1,002.847
May	9,164.024
June	8,375.781
July	7,683.319
August	7,039.674
Setember	7,146.487
October	8,188.858
November	9,499.524
December	9,918.170
Total	99,001

2010	EG_y (MWh)
January	12,255.280
February	12,458.115
March	13,021.399
April	10,965.434
May	9,799.158
June	8,470.568
July	1,395.646
August	3,990.176
Setember	6,464.651
October	7,785.575
November	8,059.483
December	9,808.761
Total	104,474

Calculation:

$BE_y = EF_{y,CM,grid} * EG_y$

2009:

BE_{2009} = 0.1635*99,001

BE_{2009} = 16,185tCO_2e

2010:

BE_{2010} = 0.3095*104,474

BE_{2010} = 32,388tCO_2e

Total baseline emissions for the second monitoring period:

$BE_{2009\text{-}2010} = BE_{2009} + BE_{2010}$

$BE_{2009\text{-}2010}$ = 16,185 + 32,388

$BE_{2009\text{-}2010}$ = 48,523tCO_2e

E.2. Project emissions calculation

According to the version 6 of ACM0002 methodology, if the power density of project activity is greater than 4 W/m² and less than or equal 10 W/m², it is necessary the calculation of the emissions from reservoir expressed as tCO2e/year. If the power density of the project activity is greater than 10W/m², than, the emissions from the reservoir are considered equal to zero.
The power density of the project activity (PD) is calculated as follows:

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

Where:
PD = Power density of the project activity (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

Thus:
PD = 21.6 MW/ 1.05 Km^2 = **20.57 W/m^2**

Once the Power Density of PCH Paraíso is greater than 10, its value is equal to zero.

E.3. Leakage calculation

The project activity involves the operation of a hydropower station and does not have emergency fossil-fuel fired generator capacity (i.e. diesel generators) installed at the project site. In accordance with the ACM0002 version 6, "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, fuel handling (extraction, processing and transport), and land inundation. Project participants do not need to consider these emission sources as leakage in applying this methodology."

E.4. Emission reductions calculation / table

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2009	0	16,185	0	16,185
2010	0	32,338	0	32,338

Total (tCO_2e)	**0**	**48,523**	**0**	**48,523**

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	**60,620**	**48,523**

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

Once the emission reduction achieved was lower than what was stipulated in the registered PDD, there is no need to justify the difference between the values above.

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History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		