



***UHE Mascarenhas* power upgrading CERs Project**

Monitoring report

Version 01

Monitoring period: from 26th May to 10th October 2008

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SECTION A. General description of the project activity

A.1 Title of the project activity:

UHE Mascarenhas power upgrading CERs project.

Version 01. Monitoring report completed on 15/10/2008.

A.2. Description of the project activity:

The project activity aims to increase the energy generation of an existing hydro power plant with reservoir, where the project foresees no changes on the volume of the reservoir. The project activity foresees the installation of the fourth generation unit with a nominal capacity of 49.5 MW, at the hydro power plant *Mascarenhas*. The Hydro Power Plant was constructed between 1968 and 1972 by the *Espírito Santo Centrais Elétricas S/A-Escelsa*, located at the *Rio Doce* river (South East Brazil), with a total installed power of 131 MW.

The *Mascarenhas* Hydro Power Plant was initially conceived to supply the energy demand within the project boundary, the state of *Espírito Santo*. Initially designed with four water intakes at the dam reservoir, the power plant was finally installed with only three Kaplan turbines with three generator of nominal capacity on 45 MW each.

The project activity carried out by *Energest*¹/EDP will use the existing hydro power scheme and the existing electric infrastructure to increase the amount of generated energy through the installation of a new Kaplan turbine with no environmental impacts at the water reservoir, thus optimizing the water flow that would be otherwise inefficiently released at the reservoir dam. Under the project activity, the level of the reservoir will not be changed (increased or decreased) and the new hydro turbine will optimize 269 m³/s that will generate a total amount of 200,604 MWh², or working a total time of 4,052 hours per year.

As result of the project activity will be displaced around 13,162,75 tCO₂equ/year³ from the baseline scenario. The *Mascarenhas* Hydro Power Plant has currently a power density⁴ of 43 W/m² and as stated by the CDM EB⁵ the GHG from the reservoir are neglected.

The *Mascarenhas* Hydro Power Plant is placed at the north of the *Espírito Santo* state, an area with high voltage fluctuation, thus the project activity will contribute to avoid a waste of energy due to the reactive energy necessary to compensate such energy instability. Therefore the most important fact is that the project activity will avoid transmission of energy from other distant states into the project activity state⁶. Moreover, the project activity will have an important impact on the environmental sustainability by reducing local air pollution and decreasing the GHGs emissions that would otherwise been emitted under the baseline scenario and will contribute to sustainable development during the construction phase (by hiring local labour), during the operation phase (payment of taxes to the municipality), environmental programs (*Energest* is highly engaged on environmental education and to assist the local stakeholders on sustainable development plans).

¹ *Escelsa* was unbundled into two main companies: *Energest* and *Celsa* on 13th June 2005.

² The estimated energy generated by the project activity is 22.9 MWaverage, however a conservative value of 22 MWaverage (192,720 MWh) will be used to estimate the emission reductions

³ The project activity aims to claim Verified Emission Reductions from 26th May to 10th October 2008.

⁴ The current reservoir area is 4.194 km².

⁵ From the EB 23 meeting held at 22 – 24 February 2006. (THRESHOLDS AND CRITERIA FOR THE ELEGIBILITY OF HYDROELECTRIC POWER PLANTS WITH RESERVOIRS AS CDM PROJECT ACTIVITIES)

⁶ The *Espírito Santo* state presents an estimated energy deficit between 85%-90% of the energy consumed.

Summarizing, the *Mascarenhas* HPP will reduce carbon dioxide emissions through the substitution of grid electricity generation and energy transmission losses from outside of the project boundary where the project activity will improve the local supply of electricity based on a clean and a renewable energy source while contributing to the local economic development through increasing environmental activities and economic benefits through real income for the local municipalities.

The project activity will likely increase the amount of capital based on the new generation activities may be translated into new and necessary investments on environmental education added to the already on place activities carried out by *Energest* and the local municipality of *Baixo Guandu*.

A.3. Current status of the project activity:

The project activity “UHE Mascarenhas Power Upgrading Project” will claim CERs and has already been registered in the UNFCCC Executive Board on 26th May 2008 (reference number 1232). The project activity has already been implemented and is working under Clean Development Mechanism according to the descriptions contained in the PDD⁷.

⁷ Available at the UNFCCC website: <http://cdm.unfccc.int/Projects/DB/SGS-UKL1183734827.45/view>

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

The approved consolidated baseline and monitoring methodology ACM0002: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” version 6 (valid from 19 May 06 onwards). The project activity relates to the sectoral scope number 1 “Renewable electricity generation for a grid”.

The project activity has currently a power density of 43 W/m² and as stated by the CDM EB⁸ can use the approved ACM0002 baseline methodology and the project emissions from the reservoir may be neglected.

B.2. Monitoring period

This report refers to the first required period of the crediting period of the project activity, which starts on the registration date (2008 May 26th) and ends in the present date (2008 October 10th).

B.3. Data and parameters applied:

Data / Parameter:	EF
Data unit:	tCO ₂ equ/MWh
Description:	CO ₂ emission factor for the grid
Source of data used:	Data obtained from ONS (National Operator System) and calculated according to the methodology ACM0002 (version 06). The emission factors of Revised IPCC Guidelines for National Greenhouse Gas Inventories were used.
Value applied:	0.262
Justification of the choice of data or description of measurement methods and procedures actually applied :	The baseline emission factor (EF_y) is calculated as the weighted average of the combination of operating margin (OM) and build margin (BM) factors. It will be calculated <i>ex-ante</i> .

Data / Parameter:	EF_OM _y
Data unit:	tCO ₂ equ/MWh
Description:	CO ₂ Operating Margin emission factor for South-East/ Central West and South system
Source of data used:	Data obtained from ONS (National Operator System) and calculated according to methodology ACM0002 (version 6). The emission factors and oxidation factor were obtained from Revised IPCC Guidelines for National Greenhouse Gas Inventories. The net calorific value (energy content) were obtained from the country specific values.
Value applied:	0.413 (average for the years 2003, 2004 and 2005)
Justification of the choice of data or description of measurement methods	Mandatory under methodology ACM0002. It will be calculated <i>ex-ante</i> .

⁸ From the EB 24 meeting held at 10 – 1 May 2006, Annex 7 – Revision to approved consolidated methodology ACM0002

and procedures actually applied :	
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Data / Parameter:	EF_{BM_v}
Data unit:	tCO ₂ equ/MWh
Description:	CO ₂ Operating Margin emission factor for South-East/ Central West and South system
Source of data used:	Data obtained from ONS (National Operator System) and calculated according to methodology ACM0002 (version 6). The emission factors and oxidation factor were obtained from Revised IPCC Guidelines for National Greenhouse Gas Inventories. The net calorific value (energy content) obtained from the country specific values.
Value applied:	0.11
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002. EF _{BM_v} was calculated <i>ex-ante</i> for a sample group <i>m</i> consists of the five power plants that have been built most recently and actually on operation

Data / Parameter:	F_{i,v}
Data unit:	Mass or volume
Description:	Fuel quantity
Source of data used:	Obtained from SIESE 2002, 2003, 2004. (National Energy statistics).
Value applied:	Variable
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

Data / Parameter:	COEF_i
Data unit:	tCO ₂ /mass
Description:	CO ₂ emission coefficient of each fuel type <i>i</i>
Source of data used:	Revised IPCC Guidelines for National Greenhouse gas Inventories 1996
Value applied:	Variable
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

Data / Parameter:	GEN_{j/k/n,v}
Data unit:	MWh/y
Description:	Electricity generation of each power source / plant <i>j</i> , <i>k</i> or <i>n</i>
Source of data used:	Obtained from CCEE (Monthly Energy Generation).
Value applied:	Variable
Justification of the choice of data or description of	Mandatory under methodology ACM0002

measurement methods and procedures actually applied :	
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Data / Parameter:	Plant name
Data unit:	Text
Description:	Identification of power source / plant for the OM
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Please refer to table 12 and 13 provided in annex 3 of the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

Data / Parameter:	Plant name
Data unit:	Text
Description:	Identification of power source/ plant for the BM
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Please see table 11 of the PDD
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002. Comprise the five most recently built plants, which comprise the larger annual generation compared to the recently built 20%.

Data / Parameter:	λ_y
Data unit:	Dimensionless Number
Description:	Fraction of time during which low-cost/ must-run sources are on the margin
Source of data used:	Calculated according to data provided by ONS
Value applied:	$\lambda_{2003}=0.530$, $\lambda_{2004}=0.504$, $\lambda_{2005}=0.513$
Justification of the choice of data or description of measurement methods and procedures actually applied :	Factor accounting for number of hours per year during which low-cost/must-run sources are on the margin. $\lambda_y = \frac{\text{hours per year for which low-cost/must-run sources are on margin}}{8760 \text{ hours per year}}$

Data / Parameter:	GEN_{i,k,l,y imports}
Data unit:	MWh
Description:	Amount of electricity imported
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Variable.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

B.4. Data and parameters monitored:

Data / Parameter:	EG_v
Data unit:	kWh
Description:	Electricity Generation delivered to grid
Source of data to be used:	Measured by project developer and monitored by the ONS.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the period of 26 th May to 10 th October 2008, the generation is of 50,239,513.00 kWh
Description of measurement methods and procedures to be applied:	It was recorded hourly and archived in electronic and paper format.
QA/QC procedures to be applied:	Data was monitored and registered by the project developer. Sales invoices will ensure consistency for the collected data. Monitored data from ONS will also be consulted. The lowest value will be employed for conservative reasons.

The table 1 shows the electric energy generation related to the first monitoring period (from 26/05/2008 to 10/10/2008) at the project activity.

Period	Generated Energy (MWh)	Generated Energy (kWh)
26/05/2008 – 10/10/2008	50,239.51	50,239,513.00

Table 1 - Amount of Energy generated at the project Mascarenhas for the period between 26/05/2008 and 10/10/2008 in MWh.

B.5. Calculation of emission reductions

The operating margin for the project boundary is calculated *ex- ante* using the full generation-weighted average for the baseline year. The amount of fuel consumption for thermal generation for the project boundary is available for 2007. The average *EF_OMy* for the project activity is 0.413 (kg CO₂equ/kWh).

The build margin approach aims to make a “best guess” on the type of power generation facility that would have otherwise been built, in the absence of the GHG mitigation project.

As noted by *Kartha et al.*,⁹ even in well-planned electricity systems, it is not easy to determine the timing and type of new electricity capacity additions. For the project activity the most recent data based on historical capacity additions are provided through the ONS.

The values for energy generation are defined through the wholesale electricity market operator (CCEE) and where data are not available, default values for the Brazilian grid system are defined¹⁰.

⁹ Martina Bosi: *Road-Testing Baselines for Greenhouse Gas Mitigation Projects in the Electric Power Sector* (OECD and IEA Information Paper COM/ENV/EPOC/IEA/SLT(2002)6). Outubro de 2002. Available at: <http://www.oecd.org/dataoecd/45/54/2766208.pdf>

The build margin is estimated *ex-ante*, based on the five most recently built plants, which comprise the larger annual generation compared to the recently built 20%, thus they represent the capacity additions to the system. The EF_{BM_y} for the selected plants is 0.11.

Finally, the baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor (EF_{OM_y}) and the Build Margin emission factor (EF_{BM_y}):

$$EF_y = (\omega_{BM} * EF_{BM_y}) + (\omega_{OM} * EF_{OM_y}) = 0.262$$

Where:

$$\omega_{BM} = 0,5$$

$$\omega_{OM} = 0,5$$

Both ω_{BM} and ω_{OM} have a value of 0,5 because the project activity is a Hydro Power Plant.

The generated energy by the project activity until the moment was monitored following the monitoring premises and is presented at the table below.

Period	Generated Energy (MWh)	Emission Factor (ton CO ₂ e/MWh)	Emission Reduction (tonnes of CO ₂ e)
26/May/2008 – 10/October/2008	50,239.51	0.262	13,162.75
Total (tonnes of CO₂ e)	-	-	13,162.75

Table 2 - Generated energy and emission reductions achieved by the project activity from registration date (26th May 2008) until 10th October 2008.

B.6. Monitoring results

Based on methodology ACM002 version 06 and on monitored data, as well as considering the high contribution to sustainability, the project participants requested CERs due to emission reductions achieved by the project activity are **13,162.75 tCO₂equ.**

B.7. Date of completion of the monitoring report and the name of the responsible person(s)/entity(ies)

The responsible for project monitoring is the project proponent (*Energest S.A.*).

The monitoring report was completed in 15 October 2008 by Beatriz Kiss from *CantorCO2e Brasil* (PDD developer).

¹⁰ OECD and IEA Information Paper, Bossi et al (2002).