energias do brasil

São João **Small Hydro Power Plant**

MONITORING REPORT
Version 01

Monitoring period: from 02nd May to 10th October 2008

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SECTION A. General description of the project activity

A.1 Title of the project activity:

São João Small Hydro Power Plant.

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A.2. Description of the small-scale project activity:

With an energy deficit of around 85-90% at the project area, the project activity aims to generate clean energy from hydropower at the *Espírito Santo* state (Southeast of Brazil); an area with a high voltage fluctuation and high transmission losses for the imported energy. Based on a run-of the river scheme with a 7 kilometres penstock entirely in rock, the power plant has an yearly energy of 14.1 $MW_{average}$, the project activity will likely reduce 6,575.11 tCO_2equ while contributing to increase the share of small hydro power generation in the rising thermal power generation scenario in Brazil.

Since 1984 there have been several governmental programs to promote the construction of small hydro power plants. The main goal of these programs was to decrease the oil consumption, promote local technology and promote rural development. However the last 20 years, several others programs to promote small hydro power generation were issued[1], small hydro power generation has not substantially increase and in opposition, thermal power generation has been used instead to supply isolated and rural areas or peak loads for the grid.

The project activity is being carried out by *Energest* an energy generation facility which is part of the *EDP* group (Electricity of *Portugal*). The project activity was granted in 1999 by *ANEEL* (National Electrical Energy Agency) and the feasibility studies, a bureaucratic process, could be initiated. The Engineering Procurement and Construction (EPC) was finally granted in the year 2000 for 37.97 MR$ to three companies (*Engevix, Toniolo* and *Impsa*). The EPC was finally rejected based on a technical default risk due to the risk of non-delivery caused by macroeconomic problems affecting the companies within the EPC.

Finally the year 2002 a new EPC was signed out between *Vatech Hydro, Energ Power, Edex* and *Engevix* with an increased cost on the EPC up to 41.5 MR$ and 24 months of leading construction time. Further alterations on the construction cost and leading time for the project activity increased the EPC cost up to 41.78 MR$ due to social taxes (+3%) and civil works. On the year 2003, three new contract adjustments increased the cost of the EPC up to 43.73 MR$ (+15% initial EPC value) due to the unexpected incremental civil cost. The main incremental cost was due to the lack of know-how by the mining company for the implementation of the penstock (mechanical excavation in rock).

In the year 2004 the EPC collapsed and the small hydro power plant was put in hold. Several alternative scenarios were considered up to this point, based on the fact that the hydro power plant was partially constructed under such scenario the project proponent requested a new EPC. At the end of 2004, the minimum value granted for the EPC was 83.82 MR$ (or + 219% or 45 MR$ of the initial EPC value).Up to this point the incremental cost of the hydro power plant were considered as a prohibitive either for the Brazilian energy standards or for the project proponent internal benchmark (as defined in the additionality check) and the project proponent defined a set of investment and trade-off scenarios.

Finally at the end of 2005 the project proponent closed the new EPC and the forecasted starting operation is scheduled on April 24, 2007.

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[1] *The National program on hydro power plants PNCE (2000) and finally the Proinfa program (2006).*

Apart from the well-known positive benefits of the construction (job creation, technology well known), the benefits from the operation of the power plant (income taxes for the municipality) and environmental programs (*Energest* is highly engaged on environmental education and to assist the local stakeholders on sustainable development plans), the power plant will decrease the GHGs emissions that would otherwise been emitted under the baseline scenario, while contributing to the local economic development through environmental activities and direct tax income based on the generation activities.

Thus, one of the most important impacts of the registration of the project activity as a CDM project it would be likely the promotion of several small hydro power schemes within the project boundary area, for a region which is highly dependent on energy imports and thermal generation.

A.3. Current status of the project activity:

The "*São João* Small Hydro Power Plant" project was already registered in the UNFCCC Executive Board at 2nd May 2008 [2] (reference number 1342) and will claim CERs. The PDD project was validated by the Designated Operational Entity BRTÜV and the monitoring report here presented will be verified by the same DOE.

The monitoring data was kept according to the monitoring plan described in the PDD. The project emissions from the reservoir were neglected. Apart from that, the project activity is grid-connected electricity generation from renewable energy sources with a power density of 119 W/m^2. The emission reductions due to the renewable energy generation resulted in 6,575.11 tCO_2equ during the monitoring period of 02/05/2008 to 10/10/2008.

[2] *More information available at UNFCCC1s website: http://cdm.unfccc.int/Projects/DB/SGS-UKL1189521894.23/view*

SECTION B. Application of monitoring methodology and results

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

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 additionality proof of the current project took into consideration the version 3 of the "Tool for the demonstration and assessment of additionality" approved by the Executive Board (Annex 1, EB16).

B.2. Monitoring period

This monitoring report refers to the first required period of the crediting period project activity, which starts on the registration date (2nd May 2008) and ends at the present date (10th October 2008).

B.3. Data and parameters applied:

Data / Parameter:	**EFy**
Data unit:	tCO_2equ/MWh
Description:	CO_2 emission factor for the grid
Source of data to be 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 of data applied for the purpose of calculating expected emission reductions in section B.5	0.262
Description of measurement methods and procedures to be 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 *ex-ante.*

Data / Parameter:	**EF_OM_y**
Data unit:	tCO_2equ/MWh
Description:	CO_2 Operating Margin emission factor for South-East/ Central West and South system
Source of data to be 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 of data applied for the purpose of calculating expected	0.413 (average for the years 2003, 2004 and 2005)

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Mandatory under methodology ACM0002. It will be calculated *ex-ante*.

Data / Parameter:	**EF_BM_y**
Data unit:	tCO_2equ/MWh
Description:	CO_2 Operating Margin emission factor for South-East/ Central West and South system
Source of data to be 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 of data applied for the purpose of calculating expected emission reductions in section B.5	0.11
Description of measurement methods and procedures to be applied:	Mandatory under methodology ACM0002. EF_BMy was calculated *ex-ante* for a sample group *m* consists of the five power plants that have been built most recently and actually on operation

Data / Parameter:	**$F_{i,y}$**
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
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:	**$GEN_{j/k/n,y}$**
Data unit:	MWh/y
Description:	Electricity generation of each power source / plant j, k or n

Source of data used:	Obtained from CCEE (Monthly Energy Generation).
Value applied:	Variable
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 OM
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Please refer to table 16 and 17 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 9 in 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:	λ_{2003}= *0.530,* λ_{2004}=*0.504,* λ_{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. $\lambda_y = \frac{hours\ per\ year\ for\ which\ low-cost/must-run\ sources\ are\ on\ margin}{8760\ hours\ per\ year}$

Data / Parameter:	**$GEN_{j,k,ll,y\ imports}$**
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_y**
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 2nd May to 10th October 2008, the generation is of 25,095,825.00 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 02/05/2008 to 10/10/2008) at the project activity.

Period	**Generated Energy (MWh)**
02/05/2008 – 10/10/2008	25,095.83

Table 1- Amount of Energy generated at the project São João *for the period between 02/05/2008 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 2003, 2004 and 2005 (last year availability of the data). The average *EF_OMy* for the project activity is 0.413 (kg CO_2equ/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.*,30F[3] 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 defined31F[4].

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 *EFy* is calculated as the weighted average of the Operating Margin emission factor (*EF_OMy*) and the Build Margin emission factor *(EF_BMy):*

$$\boldsymbol{EF_y} = (\omega_{BM} * EF\_BM_y) + (\omega_{OM} * EF\_OM_y) = 0.262$$

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 CO2e/MWh)	Emission Reduction (tonnes of CO2 e)
02/May/2008 – 10/October/2008	25,095.83	0.262	6,575.11
Total (tonnes of CO2 e)	-	-	**6,575.11**

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

B.6. Monitoring results

Based on the methodology ACM0002 version 06 and on monitored data as well considering the high contribution to sustainability, the project participants request CERs due to emission reductions achieved by the project activity is **6,575.11 tCO_2equ**.

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 José Lopes Alves from *Energias do Brasil*.

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

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[3] *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. Disponível em: http://www.oecd.org/dataoecd/45/54/2766208.pdf*

[4] *OECD and IEA Information Paper, Bossi et al (2002).*