CLEAN DEVELOPMENT MECHANISM
MONITORING REPORT

Third Verification of

ARAPUtanga **C**entrais **EL**étricas S. A. - **ARAPUCEL** - Small Hydroelectric Power Plants Project

(CDM Registration Reference Number 0530)

Monitored Period: 01 January 2008 to 31 December 2008
Crediting Period: 01 September 2002 to 31 August 2009

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Section A. General description of project activity

A.1. Title of the project activity

ARAPUtanga **C**entrais **EL**étricas S. A. - **ARAPUCEL** - Small Hydroelectric Power Plants Project (hereafter referred to as "Arapucel Project").

Document version number: 01, 01 December 2008.

Monitoring Report based on the PDD Version Number: 05, from 01 June 2006.

A.2. Description of the project activity

The primary objective of the Arapucel Project is to help meet Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to the environmental, social and economic sustainability by increasing renewable energy's share of the total Brazilian (and the Latin America and the Caribbean region's) electricity consumption.

The Latin America and the Caribbean region countries have expressed their commitment towards achieving a target of 10% renewable energy of the total energy use in the region. Through an initiative of the Ministers of the Environment in 2002 (UNEP-LAC, 2002), a preliminary meeting of the World Summit for Sustainable Development (WSSD) was held in Johannesburg in 1992. In the WSSD final Plan of Implementation no specific targets or timeframes were stated, however, their importance was recognized for achieving sustainability in accordance with the Millennium Development Goals[1].

The privatization process initiated in 1995 arrived with an expectation of adequate tariffs (less subsidies) and better prices for generators. It drew the attention of investors to possible alternatives not available in the centrally planned electricity market. At the end of the 1990's a strong increase in demand in contrast with a less-than-average increase in installed capacity caused the supply crisis/rationing from 2001/2002. One of the solutions the government provided was flexible legislation favoring small independent energy producers. Furthermore the possible eligibility under the Clean Development Mechanism of the Kyoto Protocol drew the attention of investors in small hydropower projects.

In this scenario, *Brennand Energia Group* began to consider investing in small renewable energy power projects (thermo and hydro) in Brazil. One of the main ventures of the Group, the Arapucel Project – through Araputanga Centrais Elétricas S.A., Arapucel Indiavaí S.A. and Arapucel Ombreiras S.A. companies – , started to be developed in 2001, exploring the

1 WSSD Plan of Implementation, Paragraph 19 (e): "Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies, hydro included, and their transfer to developing countries on concessional terms as mutually agreed. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiatives, where they exist, and ensuring that energy policies are supportive to developing countries' efforts to eradicate poverty, and regularly evaluate available data to review progress to this end."

hydropower potential in three locations of the Jaurú River, near the cities of Araputanga and Jaurú, in the State of Mato Grosso, Midwest of Brazil.

The project consists of three small hydroelectric power plants ("PCH", from the Portuguese, *Pequena Central Hidrelétrica*), PCH Alto Jauru (21.96 MW), PCH Indiavaí (28.0 MW) and PCH Ombreiras (26.0 MW), totalizing 75.96 MW installed capacity. The project was developed in three phases with the operations starting of the three PCHs.

Although PDD registered presents an installed power of 20 MW to PCH Alto Jauru, Project Participants call attention to the fact that the inaccuracy does not change anything in the assessment and demonstration of additionality in the PDD, as demonstrated at the time of the submission of the response to the request for review, dated 23rd August, 2007.

It is also worth mentioning that the name of PCH Alto Jauru was altered to PCH Antonio Brennand. This modification was approved by ANEEL through its Resolution nr. 618 issued on November 25th, 2003. Despite this alteration this small hydropower plant will continue to be referred to as PCH Alto Jauru once it is the way it is referred to in the registered PDD.

This indigenous and cleaner source of electricity has an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would be generating (and emitting) in the absence of the project.

A.3. Arapucel Monitoring Report

The Monitoring Report is based on the electricity delivered to the grid by Arapucel project. The GHG emissions reduction during the period from January 2007 to December 2007 was achieved through the dispatched electricity generated by PCH Alto Jauru (21.96 MW), PCH Indiavaí (28.0 MW) and PCH Ombreiras (26.0 MW), that displaced a mix of electricity generation in the Brazilian South-Southeast-Midwest Interconnected National Electric System - SIN grid.

The monitoring methodology shall be used in conjunction with the approved baseline methodology ACM0002 ("Consolidated baseline methodology for grid-connected electricity generation from renewable sources") and applies to electricity capacity additions from run-of-river hydro power plants.

The methodology is applicable to the project activity. It consists in using meter equipment projected to registry and verifying bi-directionally the energy generated by the facility. This energy measurement is fundamental to verify and monitor the GHG emission reductions. The Monitoring Plan permits the calculation of GHG emissions generated by the project activity in a straightforward manner, applying the baseline emission factor.

A.4. Period of the monitoring report and amount of monitored emissions reductions

Period of the monitoring report: 01 January 2008 – 31 December 2008

Amount of monitored emissions reductions: 150,796 tCO_2

Total crediting period of the project: 01 September 2002 – 31 August 2009

A.6. Personnel Responsible

Executive President – Mozart Siqueira (Grupo Brennand Energia)

Monitoring Report – Ricardo Esparta (Ecoinvest Assessoria Ltda.)

Project Monitoring – Agnelo Bezerra Bonfim (Grupo Brennand Energia)

Section B. Monitoring methodology and plan

B.1. Name and reference of approved monitoring methodology applied to the project activity

ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version 5).

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The chosen methodology is applicable to grid-connected renewable power generation projects, under the condition of electricity capacity additions from run-of-river hydro power plants, as is the case with the Arapucel Project.

During a period of restructuring the entire electricity market, as is the current Brazilian situation, investment uncertainty is the main barrier for small renewable energy power projects. In this scenario these projects compete with existing plants (operating margin) and with new projects (build margin), which usually attract the attention of financial investors.

According to the selected approved methodology (ACM0002), the baseline emission factor is calculated as (EF_y) is calculated as a combined margin (*CM*), consisting of the combination of operating margin (OM) and build margin (BM) factors. For the purpose of determining the build margin and the operating margin emission factors, a project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly a connected electricity system is defined as an electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints.

Although the dispatching information is considered strategic to power agents, the national dispatch center, through the Independent System Operator – ISO, ("ONS", from the Portuguese, *Operador Nacional do Sistema*) – will make it available for grid emission factor calculation. The data from ONS and CCEE - Chamber of Electric Energy Commercialization (from the Portuguese *Câmara de Comercialização de Energia Elétrica)* - or Distribution Companies will be collected every year and the project participants through CDM consultants will calculate of the emission factor.

B.3. Data to be monitored:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	Comment
1. EG_y	*Electricity generation of the Project delivered to grid*	*Energy metering connected to the grid and Receipt of Sales*	*MWh*	*M*	*15-minutes-measurement and Monthly recording*	*100%*	*Electronic and Paper*	The electricity delivered to the grid is monitored both by the powers plants and by CEMAT - Centrais Elétricas do Estado do Mato Grosso, the power utility. A Brazilian government entity, CCEE – *Câmara Comercializadora de Energia Elétrica* - controls and monitors the electricity available on the national interconnected grid. The amount of electricity delivered to the grid by the project activity is available on CCEE's and CEMAT web-sites.
2. EF_y	*CO_2 emission factor of the grid*	*Calculated*	*tCO_2/MWh*	*C*	*Every year*	*100%*	*Electronic and Paper*	*Data will be collected every year during the crediting period according the approved methodology – ACM0002.*
3. $EF_{OM,y}$	*CO_2 Operating Margin emission factor of the grid*	*Data provided by ONS (National dispatch center). Calculated according the approved methodology – ACM0002*	*tCO_2/MWh*	*C*	*Every year*	*100%*	*Electronic and Paper*	*Data will be collected every year during the crediting period according the approved methodology – ACM0002*
4. $Ef_{BM,y}$	*CO_2 Build Margin emission factor of the grid*	*Data provided by ONS. Calculated according the*	*tCO_2/MWh*	*C*	*Every year*	*100%.*	*Electronic and Paper*	*Data will be collected every year during the crediting period according the approved methodology – ACM0002*

		approved methodology – ACM0002						
5. λ_y	*Fraction of time during which low-cost/must-run sources are on the margin*	*Data provided by ONS. Calculated according the approved methodology – ACM0002*		*C*	*Every year*	*100%*	*Electronic and Paper*	*Data will be collected every year during the crediting period according the approved methodology – ACM0002*

Section C. Monitored data

As the project is neither associated with leakage effects nor with new emissions of pollutants and all other pertinent data is necessary to be analyzed and presented only at the validation phase of the project, the only data that has to be monitored going forward during the life of the contract is the electricity supplied to the grid by the project (EG_y), besides the emission factor, given that the parameters chosen for the calculation of emission reductions were ex-post. Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

The main data to be considered in determining the emissions reductions is the electricity exported to the grid. The emissions reduction is reached by applying an emission factor through the electricity dispatched to the grid, that is verified and monitored by the power plant that sells the electricity and by CEMAT.

The project sponsor proceeded with the necessary measures for the power control and monitoring. From 2005 onwards, Brennand Energia Group assumes the PCHs maintenance and operation, which were made before by Alstom. Together with the information produced by ANEEL (National Agency of Electric Energy), ONS and Regional Distribution Companies, it was possible to monitor the power generation of the project and the grid power mix. Beyond that, information about power generation and energy supplied to the grid are controlled by CCEE and the Distribution Companies that make feasible and regulate the electricity energy commercialization and are responsible for monitors monthly the energy delivered to the grid.

The energy meters are specified by the energy distribution company and approved by ONS and CCEE. Each PCH utilizes a pair of SL7000 meter, manufactured by Actaris Metering Systems. These meters are calibrated by CEMAT, according CCEE. Measurements are controlled in real time by the PCH through a Digital System and by the Electric Energy Operational Center (COG – *Centro de Operação de Geração de Energia*) located at Cuiabá through satellites. Besides, there is one more meter at every PCH, so that any problems can be detected (like water shortage, materials inside the turbines, meter inaccuracy, etc). In case of any problem, plant personnel will be put in action.

All the energy from Alto Jauru, Indiavaí and Ombreiras PCHs goes to CEMAT central meter. The quantity of energy generation considered to be invoiced to the PCHs is from CEMAT meters. At the end of every month, CEMAT sends an Energy Generation Report to Brennand Energia Group (Araputanga Centrais Elétricas S.A., Arapucel Indiavaí S.A. and Arapucel Ombreiras S.A. controller) and Brennand Energia Group compares the CEMAT's Report with its own Report for the authorization of the payment.

C.1. Data collected in order to monitor project emissions

GHG emissions by the project activity are zero.

C.2. Data collected in order to monitor baseline emissions

Following the electricity generation by plant:

MONTHS / SHPPs	ALTO JAURU	INDIAVAÍ	OMBREIRAS
January	14,811.0	19,508,5	16,961.6
February	13,982.1	17,645.1	17,350.9
March	15,099.3	18,576.0	18,618.6
April	14,246.1	18,882.6	16,946.3
May	14,262.1	17,977.4	12,979.6
June	13,673.4	17,489.7	15,402.3
July	14,060.6	17,073.9	16,832.6
August	14,118.5	17,405.6	14,014.6
September	13,863.5	17,049.2	14,014.6
October	14,462.3	17,743.1	13,560.3
November	14,075.5	19,022.5	13,556.6
December	14,794.1	19,943.7	13.801,3
TOTAL	**171,448.3**	**218,317.8**	**184,039.3**

Table 1 – Electricity generation (MWh) delivered to grid by PCH Alto Jauru, Indiavaí and Ombreiras monthly of the 2008 year

PCH	2008
Alto Jauru	171,448
Indiavaí	218,318
Ombreiras	184,039
TOTAL	**573,805**

Table 2 – Electricity generation delivered to grid by Arapucel Project yearly
(Sources: Araputanga Centrais Elétricas S. A., Arapucel Indiavaí S.A. and Arapucel Ombreiras S.A.)

Section D. Calculation of GHG emission by sources

The Monitoring Report applies the *ex-post* emission factor for project activities for the Brazilian South-Southeast-Midwest interconnected grid, Calculation of the emissions reduction is based on parameters monitored at every verification and justified during it.

D.1. Describe the formulae used to calculate emissions reductions

The emission reductions by the project activity (ERy) during a given period of year y are the product of the baseline emissions factor (*EFy*, in tCO_2e/MWh) times the electricity supplied by the project to the grid at the same period of year y (*EGy*, in MWh), as follows:

$$ER_y = EF_y \cdot EG_y \qquad \textbf{Equation 1}$$

D.2. Tables providing values obtained when applying formulae above

ARAPUtanga Centrais ELétricas S, A, - ARAPUCEL - Small Hydroelectric Power Plants Project			
Year	**Electricity Generation (MWh)**	**Baseline Emission Factor (tCO2e/MWh)**	**Emissions Reduction (tCO2e)**
2008			
01 Jan 2008 to 31 Dec 2008	573,805.4	0.2628	150,796.1

Total (tCO_2e)	**150,796**