CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Pampeana and Terra Santa Small Hydropower Plants Project Activity

(Note: the name of Terra Santa SHPP was changed to Graça Brennand, on 06/03/2009, according to ANEEL dispatch number 829 - http://www.aneel.gov.br/cedoc/dsp2009829.pdf. Since this occurred after the start of the validation process, the documents for this SHPP may be referring to both names).

PDD version number: ~~02~~06

Date (DD/MM/YYYY): ~~07~~22/~~10~~02/~~2009~~2011.

A.2. Description of the project activity:

The primary objective of Pampeana and Terra Santa Small Hydropower Plants Project Activity (Pampeana and Terra Santa SHPPs 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 2002. 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. Unfortunately the Brazilian energy market lacked a consistent expansion plan, with the biggest problems being political and regulatory uncertainties. 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 smaller independent energy producers. Furthermore the

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[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.*"

possible eligibility under the Clean Development Mechanism of the Kyoto Protocol drew the attention of investors to small hydropower projects.

This indigenous and cleaner source of electricity will also have 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.

SHP Pampeana has 28 MW of installed capacity and reservoir area of 4.17 km^2. The plant is located in the municipalities of Tangará da Serra and Barra dos Bugres, Mato Grosso state, Midwest regions of Brazil. Commercial operations are predicted to start on December 23rd, 2008.

SHP Terra Santa has 27.4 MW of installed capacity and reservoir area of 6.25 km^2. The plant is located in the municipalities of Tangará da Serra and Barra dos Bugres, Mato Grosso state, Midwest region of Brazil. Commercial operations started in 2008, when the first generating unit started its operations on June, 2008 and the second one on July, 2008.

Pampeana Energética Ltda. is the company that controls Pampeana SHPP and Várzea do Juba Energia Ltda. is the company that controls Terra Santa SHPP. Both companies are 99% from Brennand Investimentos Ltda.

Brennand Group started activities related to the energy generation projects with the construction of three small hydropower plants: Antônio Brennand, Indiavaí and Ombreiras, which is also a registered CDM Project Activity (Araputanga Centrais Elétricas S. A. - ARAPUCEL - Small Hydroelectric Power Plants Project, CDM 0530[2]).

Pampeana and Terra Santa SHPPs Project can be seen as an example of a solution by the private sector to the Brazilian electricity crisis of 2001, contributing to the sustainable development of the country and having a positive effect for the country beyond the evident reductions in GHG.

The revenues obtained from the sale of the CERs will also help the Project Activity to support the community providing social and environmental benefits. Income distribution will be derived from this project due to job creation, employees' salaries and package of benefits such as social security and life insurance, and credits of emission reductions. Additionally, lower expenditure is achieved due to the fact that money will no longer to be spent in the same amount to "import" electricity from other regions in the country. With the Project Activity the revenues will stay in the region and be used for providing the population better services and improve the availability of basic needs.

A.3. Project participants:

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[2] Source: United Nations Framework Convention on Climate Change (UNFCCC) website. Available at: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1152891235.76/view.

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Table 1 – Party(ies) and private/public entities involved in the project activity

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved whishes to be considered as project participant (Yes/No)
Brazil (host)	Pampeana Energética Ltda. (private entity)	No
	Várzea do Jubá Energia Ltda. (private entity)	
	Ecopart Assessoria em Negocios Empresariais Ltda . (private entity)	
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

~~**Table 1 – Party(ies) and private/public entities involved in the project activity**~~

Detailed contact information on party(ies) and private/public entities involved in the project activity listed in Annex 1.

A.4. Technical description of the project activity:

By legal definition of the Brazilian power regulatory agency ANEEL Resolution 652/2003[3], to be considered small hydro, the utilities must have installed capacity greater than 1 MW, but not more than 30 MW, and have a reservoir area smaller than 3 km². Only in specific projects, which are the cases of Pampeana and Terra Santa small hydropower plants, reservoir can be greater than 3 km², which represents that these small hydros reservoirs result on a minimum environmental impact. According to ANEEL resolutions, the plants are considered as small hydropower plants.

Both Pampeana and Terra Santa Small Hydroelectric Plants utilize water from Juba River (annual average flow rate 80.0 m^3/s and 77.9 m^3/s, respectively), Paraguay River basin, located in the municipalities of Barra dos Bugres and Tangará da Serra, state of Mato Grosso. Pampeana SHPP has a hydro potential 28 MW, a dam height 34.95 m and a reservoir area 4.17 km^2. Terra Santa SHPP has a hydro potential 27.4 MW, a dam height 35.35 m and a reservoir area 6.25 km^2. Pampeana and Terra Santa Small Hydropower Plants Project Activity has 55.4 MW total installed capacity and it is classified as a new hydro electric project, according ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (version ~~10~~12.1, EB ~~47~~58).

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[3] ANEEL – *Agência Nacional de Energia Elétrica*. Resolução Nº. 652, de 9 de Dezembro de 2003.

Additionally, because of its small reservoir the plant is considered a run-of-river project which are those that do not include significant water storage, and must therefore make complete use of the water flow. A typical run-of-river scheme involves a low-level diversion dam and is usually located on swift flowing streams (~~Figure 1~~Figure 1).

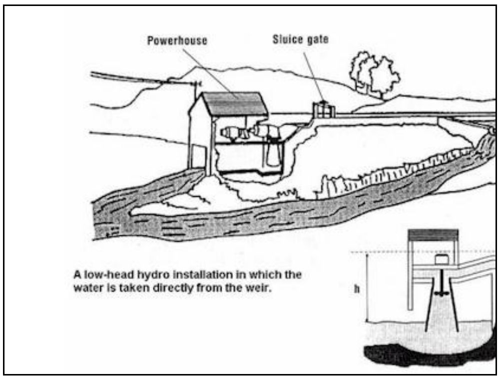

Figure 1- Schematic view of run-of-river power plant

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According to Eletrobrás (1999), run-of-river projects are defined as "the projects where the river's dry season flow rate is the same or higher than the minimum required for the turbines," as it is the case of the Pampeana and Terra Santa Small Hydro Power Plant Project. 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.

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Another way to characterize run-of-river power plants comes from the definition of the World Commission of Dams (WCD, 2000):

"Run-of-river dams. *Dams that create a hydraulic head in the river to divert some portion of the river flows. They have no storage reservoir or limited daily poundage. Within these general classifications there is considerable diversity in scale, design, operation and potential for adverse impacts."*

Finally, small hydro electric power projects are considered to be one of the most cost effective power plants in Brazil, given it is possible to generate distributed power and to supply small urban areas, rural regions and remote areas of the country.

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil.

A.4.1.2. **Region/State/Province etc.:**

Mato Grosso.

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A.4.1.3. **City/Town/Community etc:**

Tangará da Serra and Barra dos Bugres.

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A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

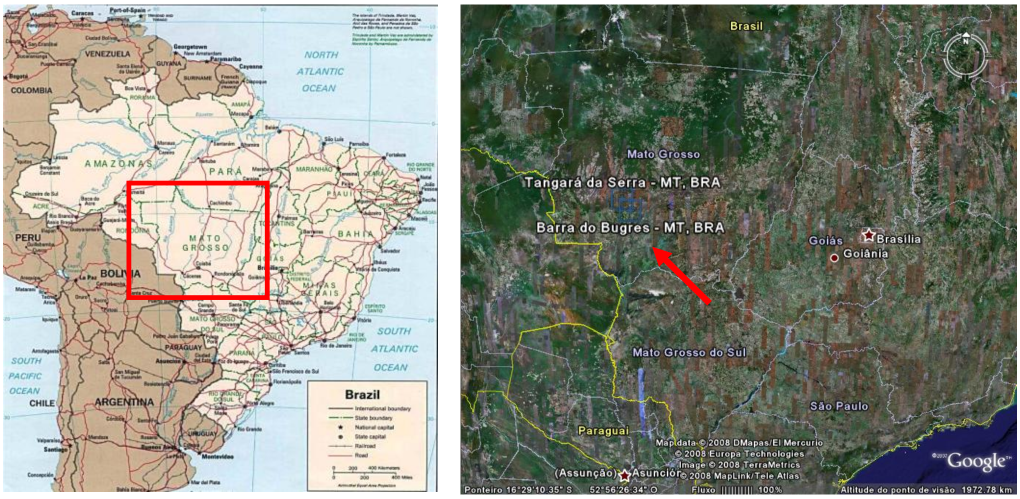

Figure 2~~1~~ – Geographical location of the project activity showing the state of Mato Grosso and the cities of Tangará da Serra and Barra dos Bugres

(Source: City Brazil, 2008[4]; Google Earth, 2008[5])

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Pampeana and Terra Santa small hydroelectric power plants are located in Juba River, Paraguay River basin, in the cities of Tangará da Serra and Barra dos Bugres, Mato Grosso State, Brazil. Terra Santa is placed upstream.

[4]Available at: <www.citybrazil.com.br>. Accessed on April 16th, 2008.

[5] Available at: <www.googleearth.com>. Accessed on April 16th, 2008.

Tangará da Serra has 76,657 inhabitants and an area of 11,566 km^2. Barra dos Bugres has 32,490 inhabitants and an area of 7,229 km^2 (IBGE, 2008).

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Projects geographical coordinates:

- Terra Santa SHPP: 14o 47' 34.75" South 57o 58' 01.92" West
- Pampeana SHPP: 14o 49' 48.29" South 57o 54' 41.68" West

A.4.2. Category(ies) of project activity:

Sectoral Scope: 1 - Energy industries (renewable - / non-renewable sources).

Category: Renewable electricity generation for a grid.

A.4.3. Technology to be employed by the project activity:

The Francis turbines, used in Pampeana and Terra Santa Small Hydropower Plants Project Activity, are the most widely used among water turbines (Figure 23).

Francis turbine is a type of hydraulic reaction turbine in which the flow exits the turbine blades in the radial direction. Francis turbines are common in power generation and are used in applications where high flow rates are available at medium hydraulic head. Water enters the turbine through a spiral tank and is directed onto the blades. The low momentum water then exits the turbine through a ducting known as suction 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 energy to the energy supplied.

Figure 32 - Example of a Francis Turbine[6]
~~**(Source: HISA, http://www.hisa.com.br/produtos/turbinas/turbinas.htm)**~~

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The equipment and technology used in Pampeana and Terra Santa Small Hydropower Plants Project Activity has been successfully applied to similar projects in Brazil and around the world.

[6] Source: HISA, http://www.hisa.com.br/produtos/turbinas/turbinas.htm

The technology of SHPs is well known in Brazil, and it is a safe and sound technology, using equipments made in Brazil. Manufactures of the equipments for SHPs have been in Brazil for some decades.

There were no equipments operating prior to the start of the implementation of the project activity. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

Technical description (Table 2) of the facility follows:

Table 2 – Technical configuration of Pampeana and Terra Santa SHPPs

	Description	Pampeana SHPP	Terra Santa SHPP
Turbines	Type	Francis	Francis
	Quantity	3	3
	Nominal power (MW)	9.3	9.5
	Manufacturer	Vatech Hydro do Brasil Ltda.	Vatech Hydro do Brasil Ltda.
Generators	Type	Synchronous	Synchronous
	Frenquency (Hz)	60	60
	Rotation (rpm)	320	320
	Quantity	3	3
	Nominal power (MW)	9.~~33~~73	9.14
	Nominal tension (kV)	13.8	13.8
	Manufacturer	Weg Equipamentos Elétricos S.A.	Weg Equipamentos Elétricos S.A.

~~**Table 2 – Technical configuration of Pampeana and Terra Santa SHPPs**~~

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Considering the emission factor determined by the Brazilian DNA for the year 2007 (0.1842 $tonCO_2e/MWh$), applicable to grid-connected renewable power generation project activities in Brazil, the full implementation of the small hydropower plant connected to the Brazilian interconnected power grid will generate the estimated annual reduction as in Table 3 below.

Table 3 - Project Emission Reductions Estimation

YearsYears	Annual estimation of emission reductions in tonnes of CO2eAnnual estimation of emission reductions in tonnes of CO_2e
Year 1 - (20110) (*)(*)	16.79634,44022,960
Year 2 - (20121)	25.19434,440
Year 3 - (20132)	25.19434,440
Year 4 - (20143)	25.19434,440
Year 5 - (20154)	25.19434,440
Year 6 - (20165)	25.19434,440
Year 7- (20176)	25.19434,440
Year 8- (20178) (**)	8.39811,480
Total estimated reductions (tonnes of CO_2e)	176.358241,082
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	**25.19434,440**

Table 3 - Project Emission Reductions Estimation

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(*) From MayJuly 1st on
(**) Until AprilJune 30th

A.4.5. Public funding of the project activity:

This project does not receive any public funding and it is not a diversion of ODA.

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:

ACM0002 - “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (Version 12.10).

The ACM0002 methodology refers to the latest approved versions of the following tools:

- Tool to calculate the emission factor for an electricity system (Version 1.12);
- Tool for the demonstration and assessment of additionality (Version 5.2);
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version 2).

The "Combined tool to identify the baseline scenario and demonstrate additionality" is also mentioned in methodology ACM0002. However, the proposed project activity neither consists of a retrofit nor is the replacement of an existing grid-connected renewable power plant/unit(s) at the project site. Hence, this tool isn't going to be used.

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

The methodology ACM0002 (version 12.10), 2009), for grid-connected electricity generation from renewable sources, uses derived margins, which have been applied in the context of the project activity through the determination of the emissions factor for the interconnected Brazilian grid (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).

Pampeana and Terra Santa Small Hydro Power Plant Project utilizes the *Tool to calculate the emission factor for an electricity system* and the *Tool for the demonstration and assessment of additionality*. The *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* is not applicable to the project activity, and then it is not used.

Pampeana and Terra Santa Small Project meets all the criteria established by the ACM0002 methodology, being a small hydro project interconnected to the electricity grid with new reservoir and with power density 6.71 W/M^2 and 4.38 W/M^2 respectively (greater than 4 W/m^2, see section B.6.3).

B.3. Description of the sources and gases included in the project boundary

As described in ACM0002 methodology, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system which the CDM project power plant is connected to, as described by Figure 4. On May 26th, 2008, the Brazilian Designated Authority published Resolution nr. 8 that defines a single system for the whole Brazilian Interconnected Grid[7].

[7] Available at: <http://www.mct.gov.br/upd_blob/0024/24719.pdf>..

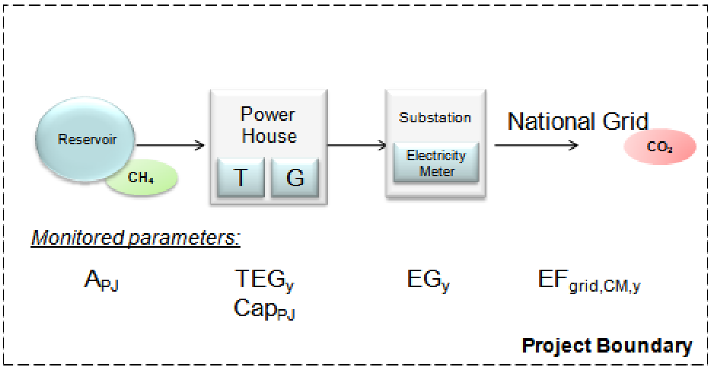

Figure 4 - Project Boundary of the project activity.

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The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the T~~below t~~able 4.

Table 4 - GHG and emissions sources included in or excluded in the project boundary

	Source	Gás	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the Project Activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	Emission of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	Yes	This source of emission corresponds to GHG emissions from reservoirs. It was included because the power density of the reservoir of both plants is between the limits of 4 and 10 W/m².
		N_2O	No	Minor emission source.

	~~Source~~	~~Gas~~	~~Included?~~	~~Justification/Explanation~~
~~Baseline~~	~~Electric energy use~~	~~CO2~~	~~Yes~~	~~To generate electricity as happen in thermo plants emits greenhouse gases such as carbon dioxide "CO2"~~

~~Project Activity~~	~~Emission from reservoir~~	~~CH4~~	~~No~~	~~This source of emission corresponds to GHG emissions from reservoirs. It was included because the power density of the reservoir of both plants is between the limits of 4 and 10 W/m².~~

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The project activity does not modify or retrofit any existing electricity generation facility. Hence, accordingly to ACM0002 the baseline scenario is the following:

"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations as described in the "Tool to calculate the emission factor for an electricity system".

In the absence of the project activity, all the energy would be imported from the interconnected grid. Hence, the baseline scenario is identified as the continuation of the current (previous) situation of electricity. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would be generated (and emitting) in the absence of the project. According to ANEEL (2007), 75 % of the Brazil's generation is composed by hydro and 21 % by thermal power stations (see step 04, section B.5).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The CDM glossary of terms defines the starting date of a non A/R project activity as "the earliest date at which either the implementation or construction or real action of a project activity begins".

From the above definition, the following dates were analyzed (Table 5):

Table 5 - Dates related to the starting date of project activity

~~For both plants:~~

~~- GSP: from 15/10/2008 to 13/11/2008;~~

~~- Starting date of the project activity: 18/05/2006 (construction permit for Terra Santa)~~

~~- Contract with Ecopart: 28/05/2008.~~

~~Pampeana SHPP:~~

~~- Financial closure: 28/09/2006~~

~~- Construction permit: 16/02/2007~~

~~- Construction start: 15/04/2007~~

~~- Purchase of the main equipment: 01/07/2006~~

- PPA: 12/12/2007

Terra Santa SHPP:

- Construction permit: 18/05/2006

- Purchase of the main equipment: 01/07/2006

- Financial closure: 28/09/2006

- PPA: 02/11/2006

- Construction start: 15/12/2006

Dates		Actions
Pampeana SHPP	Terra Santa SHPP	
16/2/2007	18/5/2006	Construction Permit
1/7/2006	1/7/2006	Purchase of the main equipment
28/9/2006	28/9/2006	Financial Closure
12/12/2007	2/11/2006	PPA signature
15/04/2006	15/12/2006	Construction Start
28/5/2008	28/5/2008	Contract with Ecopart
15/10/2008	15/10/2008	GSP publication

- The first real action of the project was on JulyMay 01st, 18th, 2006, when Várzea do Jubá Energia Ltda. purchase order of main equipmentsreceived the Construction License for Terra Santa from the Mato Grosso Environmental Agency. , tThis date is considered as the project starting date (mentioned in section C.1 of this PDD). All evidences related to the starting date presented above are available with Project Participants.

The consideration of CDM incentives and feasibility study is dated of October 3rd, 2005, which consists of an economical evaluation created by Brennand and perfected during the project´s development resulting on IRR calculation spreadsheet.. This can be evidenced through a Minutes of Meeting held by São João Energética Ltda. and Nova Energética Ltda., in which both companies decided to implement the SHPPs, considering the revenues of the CDM.

The objective of the meeting mentioned above was to present the results of the feasibility study made for Pampeana and Terra Santa Small Hydroelectric Projects, owned by São João Energética Ltda. and Nova Energética Ltda, respectively. All Board members, including the president Mr. Mozart de Siqueira Campos Araújo and his secretary Mr. Pedro Pontual Marletti, were present. In this meeting, the Board members decided for the project acquisition, considering the fact that the project could be registered as a CDM project activity, being capable to generate carbon credits.

In 2005, São João Energética Ltda., was the owner of Pampeana SHPP and Nova Energética Ltda. the owner of Terra Santa SHPP. Both companies, that held the mentioned meeting, are owned by Brennand Group. On April 3rd, 2007, São João Energética Ltda. was incorporated by Pampeana Energética Ltda. and Nova Energética Ltda. was incorporated by Várzea do Jubá Energia Ltda., the

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owners of the SHPPs currently. This can be evidenced through ANEEL Authorizative Resolution nr. 863, dated April 3rd, 2007. All evidences will be presented to DOE and it is available under request.

Through evidences mentioned above, it can be evidenced that consideration of CDM was always taken for Pampeana and Terra Santa Small Hydroelectric Projects. Additionally, it is important to stress that Brennand Group has three small hydropower plants - Antônio Brennand, Indiavaí and Ombreiras - which are also a registered CDM Project Activity (ARAPUtanga Centrais Elétricas S. A. - ARAPUCEL - Small Hydroelectric Power Plants Project, CDM 0530[8]). This is another evidence of Brennand Group's confidence in the CDM and in the certified emission reductions potential to help projects overcoming implementation barriers.

Before project implementation, and during it, continuous actions were taken to ensure the CDM status of the project, Project Participants held a timeline indicating the related milestones:

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Table 6 - Summary of actions for CDM consideration of the Project Activity

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Estimated dates	**Actions**
21/02/2003	Brennand hires EcoInvest (Ecopart´s former name) to advice the Group in matters relating to CDM and CERs negotiation.
3/10/2005	Directors Board Meeting considering the implementation of the project considering the carbon credits revenues
15/12/2006	Registration of Brennand´s CDM project activity - *ARAPUtanga Centrais Elétricas S. A. - ARAPUCEL - Small Hydroelectric Power Plants Project, CDM 0530*
01/02/2007	Preliminary data of Pampeana and Terra Santa CDM project is requested
14/3/2008	BRTUV validation proposal receipt
28/4/2008	Ecopart proposal signature
11/09/2008	BRTUV proposal signature
15/10/2008	PDD - GSP publication
21/11/2008	Validation Site Visit

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Additionally, the knowledge of possible CDM benefits can be also demonstrated by Brennand ´s experience with the other CDM project registered in 2006, ARAPUtanga Centrais ELétricas S. A. - ARAPUCEL - Small Hydroelectric Power Plants Project (0530)[9].

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For the demonstration of additionality, the proposed baseline methodology refers to the Additionality Tool (here version 5.2, the most recent one at the time of PDD development, will be used) approved by the Executive Board. The tool considers some important steps necessary to determine

[8] Source: United Nations Framework Convention on Climate Change (UNFCCC) website. Available at: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1152891235.76/view.

[9] Source: United Nations Framework Convention on Climate Change (UNFCCC) website. Available at: http://cdm.unfccc.int/Projects/DB/TUEV-SUED1152891235.76/view

whether the project activity is additional and to demonstrate how the emission reductions would not occur in the absence of Pampeana and Terra Santa SHPPs Project. The application of the above mentioned tool is describe in the next paragraphs.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulation

Sub-step 1a. Define alternatives to the project activity:

To define the alternatives to the project activity, there is a two-sided analysis, taking into consideration the perspective of the project owner and the perspective of the country.

Scenario 1: The alternative to the project activity is the continuation of the current (previous) situation of electricity supplied by the existing power plants from the interconnected system. From the country's perspective, the alternative for producing a similar amount of energy, as the one the project is to provide, is:

- The continuation of the current (previous) situation of electricity supplied mostly by large hydro with large reservoirs and thermal power stations.

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A recently published book, produced by authors from the University of São Paulo in May 2009, analyzes the expansion of the Brazilian national electricity system and considers that the technical-economic limit of hydropower projects is almost reached. In this context, the study points as a trend the implementation of fossil fuel thermal power plants or large projects in regions like the Amazon. The study states that, although investment in renewable energy in a long term planning is being made, the Brazilian energetic matrix tends toward a more intensive use of carbon, mainly through the insertion of natural gas and coal thermal power plants.

Original text, in Portuguese: "*A questão, porém, é como se dará a expansão do sistema elétrico nacional, já que nos aproximamos do limite técnico-econômico dos aproveitamentos hidrelétricos socialmente aceitáveis, e as alternativas apontam ou para a instalação de termelétricas à combustível fóssil, ou para obras de grande porte em regiões como a Amazônia. (...) Pelo exposto, principalmente em relação ao planejamento de mais longo prazo, apesar do grande investimento previsto em energias renováveis, principalmente na expansão hidrelétrica, a matriz energética brasileira tende a ser cada vez mais intensiva em carbono, principalmente pela inserção das termelétricas a gás natural e carvão*".

(Source: *O Setor Elétrico Brasileiro No Enfrentamento Dos Desafios Climáticos: Oportunidades Ocultas No Aproveitamento De Desperdícios* – Brazilian Electrical Sector Facing Climate Challenges: Hidden Opportunities for Energy Waste Reduction, by Flávio de Miranda Ribeiro, Francisco Carlos B. Santos and Marcos Praxedes – http://www.usp.br/mudarfuturo/2009/cap4.htm, with an abstract in English, and http://www.usp.br/mudarfuturo/2009/, São Paulo, May/2009).

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Scenario 2: ~~From the project owner's perspective, the project allows the company to export electricity to the grid. Hence, the alternative to the project activity is:~~ The proposed project activity undertaken without being registered as a CDM project activity.

Sub-step 1b. Consistency with mandatory laws and regulations:

Both alternatives, the project activity and the alternative scenario, are in compliance with all regulations according to the following entities:

- National Electric System Operator (ONS from the Portuguese *Operador Nacional do Sistema Elétrico*) - http://www.ons.org.br:
  - Grid procedures;
  - Integration of Facilities to the National Integrated Electricity System
- Electricity Regulatory Agency (ANEEL from the Portuguese *Agência Nacional de Energia Elétrica*) - http://www.aneel.gov.br/?idiomaAtual=1;
  - Resolution No. 433 de 26/08/2003 - http://www.aneel.gov.br/cedoc/bres2003433.pdf (which defines the procedures and conditions for test operation and commercial operation of companies of generation of electrical energy;
  - Periodic audit reports.
- Mato Grosso Environmental Agency (from the Portuguese *Secretaria de Estado do Meio Ambiente - SEMA*) - http://www.sema.mt.gov.br/;
  - Operation License No. 296.975/2009, issued on 04 / 03 / 2009 for Pampeana Energética S/A (Pampeana);
  - Operation License No. 297.176/2009, issued on 02 / 04 / 2009 for Várzea do Juba Energética S/A (Graça Brennand/Terra Santa).
- The CDM Executive Board.

SATISFIED/PASS – Proceed to Step 2

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

Once the project activity generates other financial benefit other than CDM related income (sale of energy) Option I could not be chosen. Option III is more appropriate when compared to Option II because there are no other options of investment from the project owner perspective. Therefore, additionality is demonstrated through an investment benchmark analysis (option III).

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Sub-step 2b and 2c– Option III – Apply benchmark analysis

The financial indicator identified for Pampeana and Terra Santa SHPP Project Activity is the equity IRR. The IRR here presented is compared to the appropriate benchmark ~~of the sugar and ethanol~~for the present project activity ~~sector, which~~ is the Cost of Equity – Ke.

Cost of Equity (Ke)

The Capital Asset Pricing Model (CAPM) is one of the most widely accepted models used to determine the (theoretically appropriate) required rate of return on equity. The CAPM calculates a newly introduced asset's non-diversifiable risk. CAPM takes into account the asset's sensitivity to non-diversifiable risk, better referred to as beta (β). Embedded in the model is also the market premium which can be tracked using historical data from the local or relevant equity market.

The rate which should be charged for the equity component of a project is calculated through the formula: **Ke = Rf - π + β*~~(~~Rm~~ – Rf)~~** where **Ke** represent the suggested rate of return for equity investments. **Rf** stands for the risk free rate and beta, or **β,** stands for the average sensitivity of comparable companies in that industry to movements in the underlying market.

Rf chosen was of a long term bond issued by the host country denominated in American dollars. Rf already accounts for the risks of investing in that particular country since the yield of the title is greater than the yield on a similar bond of a mature market.

~~(~~Rm ~~– Rf)~~ represents the market premium, or higher return, expected by market participants in light of historical spreads attained from investing in equities~~ versus risk free assets such as the US treasury~~.

~~The risk-free rate used for Ke calculation was based on the US Treasury bond, which are long term titles of a mature market. Over this rate, Brazilian country risk have been considered and resulted in the risk-free rate applied to the calculation.~~

β derives from the correlation between returns of US companies from the sector and the performance of the returns of the US market. β have been adjusted to the leverage of Brazilian companies in the sector, reflecting both structural and financial risks. β adjusts the market premium to the sector.

The market premium is estimated based on the historical difference between the S&P 500 returns and the long term US bonds returns. The spread over the risk-free rate is the average of the difference between those returns.

Each assumption made and all data used to estimate the Ke through CAPM have been presented to the DOE. The spreadsheet used for calculation of the Ke has also been provided to the DOE.

Ke = 16.2%, as shown in the cost of capital calculation spreadsheet, presented to the DOE verification. ~~"Ke CAPM.xls".~~

The table below presents the more significant values considered in the spreadsheet as well as the reference documentation.

Table 7 – Cost of Equity

Cost of Equity	
(Rf) Yield of Sovereign BB Debt[10]	*8.25%p.a.*
(π) - US inflation[11]	*1.81%p.a*
(Rm) International Market Equity Risk Premium[12]	*6.47%p.a.*
(β) Adjustment to Market Equity Risk[13]	*1.51%p.a.*
Cost of Equity with Brazilian Country Risk	*16.20%p.a.*

Financial Indicator, Internal rate of return (IRR)

As mentioned above, the financial indicator identified for SHPP Pampeana and SHPP Terra Santa is the project Internal Rate of Return (IRR). The table below presents the more significant values considered in the spreadsheet as well as the reference documentation.

Table 18 – Main parameters included in the project cash flow

Parameter	**Value (thousand)**	**Reference documentation**
Investment	Pampeana: BRL 107,699.9 Terra Santa: BRL 119,350.5	Values in the Budget submitted to BNDES adjusted to the General Market Price Index (Índice Geral de Preços de Mercado - IGP-M).
O&M costs	Pampeana BRL 2,237	9% of project revenues, based on

[10] 28-year Brazilian Federal Bond. source: Banco Central do Brasil, available at <http://www.bcb.gov.br/pec/indeco/Port/ie5-27.xls> .

[11] Yields on Treasury inflation protected securities (TIPS) adjusted to constant maturities. Source: U.S. Treasury, available at <http://www.federalreserve.gov/releases/h15/data/Annual/H15_TCMII_Y10.txt>

[12] Historical S&P500 premium over US-Treasury Bond. Source: Adamodaran website: <http://pages.stern.nyu.edu/~adamodar/>.

[13] Average unlevered Beta of Electric-Generators in the USA re-levered to sectoral leverage in Brazil. Source: Adamodaran website: <http://pages.stern.nyu.edu/~adamodar/pc/archives/emergcompfirm05.xls>.

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	Terra Santa: BRL 2,214	costs of similar Projects . Eletrobrás studies on SHPP
Managerial Costs	Pampeana BRL 1,491 Terra Santa: BRL 1,476	6% of project revenues, based on costs of similar Projects. Eletrobrás studies on SHPP
Transmission and tributary Costs	Pampeana: BRL 1,830 Terra Santa: BRL 1,766	8% of project revenues, based on costs of similar Projects. Eletrobrás studies on SHPP
Equipment´s periodic preventive maintenance	BRL: 10,000 / 10 years	Preventive equipment's maintenance cost that is expected to occur at 10 year interval. Eletrobrás studies on SHPP
Energy price	BRL 109,89 BRL 80.38	According to the energy auction held in 2005 for new hydropower plant projects inflation targeting in Brazil (2006-2009). Information available at CCEE's website: <http://www.ccee.org.br/> and Banco Central do Brasil (BACEN) According to historical price of The Spot Price, also called Settlement Price for the Differences (translation for Preço de Liquidação das Diferenças - PLD)
Amount of electricity dispatched to the grid per year	Pampeana: 196,487 MWh/year Terra Santa: 192,187 MWh/year	Based on the assured energy Portaria MME n 135 (assured energy) issued on June 25, 2007
Taxes	PIS: 0.65% COFINS: 3% Social Taxes:1.08% (9% of 12%) IRPJ: 2% (25% of 8%)	PIS: Law nr. 10,637, December 31st, 2002 COFINS: Law nr. 10,833, December 29th, 2003. Law nr. 8,981, January 20th, 1995 Law nr. 9,430, December 27th, 1996
Depreciation	3,33% (30 years)	ANEEL Resolution nr. 44 dated March 17th, 1999 (items 35 and

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		85 of this resolution).
Fair Value	Pampeana: BRL 20.327 Terra Santa: BRL 15.463	Calculated at the financial analyses spreadsheet. Included at the end of the assessment period as a cash inflow in the final year. Fair value inclusion on the cash flow is a conservative measure since the full value of the capital expenditure had not been consumed. The value considers the total construction value and the depreciation amount accounted in the cash flow.

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Sub-step 2c - Calculation and comparison of financial indicators

The cash flow of the project activity, containing the calculation of the equity IRR of the project activity was provided to the DOE in a separate annex to this CDM-PDD. The relevant assumptions made are in accordance with the *Guidance on the Assessment of Investment Analysis*.

Equity IRR, as presented to the DOE, is 11.559.27%, for Terra Santa, and 12.3312.94%, for Pampeana. These numbers show that the IRR of the project is lower than the Ke of the sector – 16.2 % - which is the benchmark. Hence, it is evident that the project activity is not financially attractive to the investor (Table 6).

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Table ~~6~~ 9 – Comparison between Project's IRR and ~~investor's WAC~~ Cost of Equity – Ke ~~C~~

	IRR (%)	Ke (%)
Terra Santa	~~11.55~~9.27%	16.2%
Pampeana	~~12.33~~12.94%	16.2%

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Sub-step 2d: Sensitivity analysis

The sensitivity analysis, as established by the "*Guidance on the Assessment of Investment Analysis*" (EB 41, Annex 45), is to be conducted considering variables that constitute more than 20% of either total project costs or total project revenues, including initial investment costs. Hence, variations will be done, according to the latest version of the Guidance on the Assessment of Investment Analysis increasing project's revenues (~~price~~ tariff increase~~of electricity~~) or the energy generation or the load factor by 10%, and reducing investment expenses and operation and maintenance costs by 10%.

The results are presented below.

Table ~~7~~ 10 – Results of the sensitivity analysis – Terra Santa SHPP.

Terra Santa	IRR	Ke
Original IRR	~~11.55~~9.27%	16.2%
Tariff increase	~~14.97~~11.79%	16.2%
Energy generation increase	~~14.97~~11.79%	16.2%
Load factor increase	~~14.97%~~11.79%	16.2%
Cost of O&M reduction	~~15.38~~9.98%	16.2%
Investment reduction	~~12.46~~12.01%	16.2%

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Table 11 – Results of the sensitivity analysis – Pampeana SHPP.

Pampeana	IRR	Ke
Original IRR	12.94%~~12.33%~~	16.2%
Tariff increase	15.72%~~15.20%~~	16.2%
Energy generation increase	15.72%~~14.97%~~	16.2%
Load factor increase	15.72%~~15.20%~~	16.2%

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Cost of O&M reduction	15.80%~~14.49%~~	16.2%
Investment reduction	15.32%~~15.26%~~	16.2%

A typical investor of the sector would not be attracted in investing in the project since the IRR is lower than the benchmark. That would be the case even when a positive variation of 10% would occur in energy prices or in energy generation or in load factor, or a negative variation of 10% would occur in total costs or in total investments of the project, as presented in the table above.

Energy assured and installed capacity of a power plant are established by the Brazilian government and are not expected to increase. According to the Brazilian legislation[14], the project concession shall be based on the maximum installed power and energy generation of the power plant (the project cannot be inefficient, should be implemented as effectively as possible). The assured energy and the installed capacity of a power plant are not freely determined by the PPs, but are officially established by the Brazilian Mines and Energy Ministry. For this reason, an increase of 10% in the plants load factor or in energy generation is not reasonable in the project context and is not expected to occur. It is included in this analysis to attend Annex 11, EB48 – "Guidelines for the Reporting and Validation of Plant Load Factors".

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Outcome: The IRR of the project activity without being registered as a CDM project is below the benchmark under all conditions analyzed; hence, not financially attractive.

SATISFIED/PASS – Proceed to Step 3

Step 3. Barrier analysis

Not applicable.

Step 4. Common practice analysis
Sub-step 4a. Analyze other activities similar to the proposed project activity:

According to the additionality tool (version 5.2), "*projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc*". Thus, the following criteria were considered in order to choose the projects that are similar to Pampeana:

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- ***Country/region:*** Brazil has an extension of 8,514,876.599 square kilometres[15] (with over 4,000 km distance in the north-south as well as in the east-west axis) and 6 distinct climate regions: sub-

[14] MME Decree # 5,163, dated July 30th, 2004.

[15] Available at: http://www.ibge.gov.br/english/geociencias/cartografia/default_territ_area.shtm.

tropical, semi-arid, equatorial, tropical, highland-tropical and Atlantic-tropical (humid tropical). These varieties of climate obviously have strong influence in the technical aspects related to a small hydropower plant implementation.

In addition, hydroelectric projects can differ significantly from each other considering the region to be implemented, climate, topography, availability of transmissions lines, river flow regularity, etc. For those reasons alone it is extremely difficult and not reasonable to compare different hydropower potential and plants. Moreover, hydro-power plants cannot be optimally placed (close to load centers and transmission lines) and easily transferred (moved to a new region where a better tariff is offered) as, for example, modular fossil-fuel-fired (diesel, natural gas) power plants. Differences may be even larger if no big water storage is possible, as in the case of small hydropower plants.

Considering information above, only small hydropower plants located in the same region of the project – Mato Grosso state – were analyzed.

- ***Scale:*** As mentioned in section A, according to Brazilian regulations, small scale hydropower plants are defined as plants with an installed capacity within 1 and 30MW[16]. Therefore, no large scale hydropower plants (e.g. installed capacity over 30MW) were considered.

- ***Same environment with respect to regulatory framework*****:** Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 onwards, due to the increase in international interest rates and the lack of investment capacity of the State, the government started the privatization process. However, by the end of 2000 results were still modest. Further initiatives, aiming to improve electric generation in the country, were taken between the 1990's and 2003; however it did not attract new investment to the sector. In 2003 the recently elected government decided to fully review the electricity market institutional framework in order to boost the investments in the electric energy sector. The market rules were changed and new institutions were created as Energetic Research Company (in a free translation from the Portuguese *Empresa de Pesquisa Energética – EPE*) – an institution that would become responsible for the long term planning of the electrical sector with role of evaluating, on a perennial basis, the safety of the supply of electric power – and Chamber for the Commercialization of Electric Power (CCEE) – an institution to manage the commercialization of electric power within the interconnected system. This new structure was approved by the House of Representatives and published in March of 2004[17]. Given the new *regulatory framework and investment climate PP* considered only projects starting after March of 2004.

- ***Same environment with respect to investment climate, access to technology and financing*****:** As mentioned in the item "country/region" above, depending on the project location, differences related to the technical aspects of a small hydropower plant project, even if small hydro projects are located in the same region. These technical differences obviously have influence in the

[16] *ANEEL – Agência Nacional de Energia Elétrica. Resolution # 652, issued on December 9th, 2003.*

[17] http://www.planalto.gov.br/CCIVIL/_Ato2004-2006/2004/Lei/L10.848.htm.

investment/financing of a project. Also, it has to be taken into account that project sponsors have different investment capacity. Then, financial information should be considered when small hydro projects were analyzed. However, project participants excluded this item for the purpose of common practice analysis.

Considering information above, Project Participants (PPs) researched about the generating units of small hydro power plants in Brazil that started operations from April 2004 to June 2009 (the most recent data available until the elaboration of this PDD) in the Mato Grosso state. Also, it can be identified the small hydros that received some kind of incentive (PROINFA[18] and/or CDM) or not.

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Table ~~5~~ 12 – Operations start of SHPPs from 2004 to 2009.

No SHPP started operations in 2004 in Mato Grosso (MT) state.

Started operations in 2005:

Name	State	Coordinates	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CDM	Proinfa
Camargo Corrêa	MT	14° 20' 47'' S 56° 47' 41'' W												2,00		
Faxinal II	MT	10° 09' 44'' S 59° 27' 28'' W											10,00		x	
Ombreira	MT	15° 06' S 58° 44' W							26,00						x	
Salto Corgão	MT	14° 27' 33'' S 59° 30' 23" W						13,50	13,50						x	

Started operations in 2006:

[18] Alternative Electricity Sources Incentive Program (in a free translation from the Portuguese *Programa de Incentivo às Fontes Alternativas de Energia Elétrica – PROINFA*), created through the Law # 10,438 dated April 26th, 2002. Among others, one of the initiative's goals is to increase the renewable energy sources share in the Brazilian electricity market, thus contributing to a greater environmental sustainability. In order to achieve such goals, the Brazilian government has designated the federal state-owned power utility Eletrobrás (Centrais Elétricas Brasileiras S/A) to act as the primary off-taker of electric energy generated by alternative energy facilities in Brazil, by entering into long-term Power Purchase Agreements with alternative energy power producers, at a guaranteed price of at least 80% of the average energy supply tariff charged to ultimate consumers. Also, the Brazilian Decree # 5,025 dated March 30th, 20041, which regulates the Law # 10,438, states that PROINFA aims for the reduction of greenhouse gases as established by the United Nations Framework Convention on Climate Change (UNFCCC) under Kyoto Protocol, contributing to the sustainable development. Therefore, the program is clearly a "Type E-" policy.

Name	State	Coordinates	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CDM	Proinfa
Aquarius	MS/MT	17° 37' S 54° 55' W									4,20				x	x
Camargo Corrêa	MT	14° 20' 47'' S 56° 47' 41'' W	2,00													
Canoa Quebrada	MT	12° 47' 00'' S 56° 00' 00'' W												28,00	x	x
Garganta da	MT	13° 23' 16'' S 57° 35' 27'' W											14,65	14,65	x	
Sacre 2	MT	13° 01' 11'' S 58° 11' 11'' W									10,00	20,00			x	
Senador Jonas	MT	16° 06' 33'' S 55° 22' 36'' W									6,30					x

Started operations in 2007:

Name	State	Coordinates	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CDM	Proinfa
Braço Norte IV	MT	09° 41' S 54° 58' W											14,00		x	
José Gelásio da	MT	16° 42' 00'' S 54° 45' 36'' W		23,70												x
Rondonópo	MT	16° 39' 58'' S 54° 43' 56'' W												26,60		x
Salto	MT	15° 35' S 58° 35' W												19,00	x	

Started operations in 2008:

Name	State	Coordinates	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CDM	Proinfa
Graça Bernnand	MT	14° 47' 35" S 57° 58' 02" W						18,27	9,13						x	
Paranating	MT	20° 30' 29" S 41° 16' 51" W		9,67	9,67	9,67									x	
Pequi	MT	16°00'13'' S 55°06'56'' W												6,00		
Sucupira	MT	15°59'31'' S 55°05'15'' W										4,50				

Obs: Graça Brennand is the new name of Terra Santa

Sources: Agência Nacional de Energia Elétrica (ANEEL), 2007 and United Nations Framework Convention on Climate Change (UNFCCC), 2007.

In number of SHPPs, there were 18 which started operations from 2004 to 2008 in Mato Grosso state , where 14 received some kind of incentives (CDM or Proinfa). In terms of installed power, it represents 95.4 % of the total 315 MW.

For the year of 2005, among the 4 SHPPs which started operations, 3 received incentives. In terms of generating units, it represents 97 % from the total of 65 MW.

For the year of 2006, when Pampeana and Terra Santa started activities, among the 6 SHPPs which started operations, 5 received incentives. In terms of generating units, it represents 98 % from the total of 99.8 MW.

For the year of 2007, among the 4 SHPPs which started operations, all received incentives. In terms of generating units, it represents 100 % from the total of 83.3 MW.

For the year of 2008, among the 4 SHPPs which started operations, two received incentives. In terms of generating units, it represents 84.3 % from the total of 66.9 MW.

From this result, it is clearly demonstrated that common practice for SHPPs is the implementation of the activity through the CDM and/or Proinfa incentives. Through numbers presented above, it can be proved that it is required a strong incentive to promote the construction of renewable energy projects in Brazil, where it includes SHPPs.

Sub-step 4b. Discuss any similar options that are occurring:

Considering information above, the majority situation of small hydro projects in Brazil is the implementation of this type of project with some kind of incentives. Considering units which started operations in the same region of Pampeana and Terra Santa Project in 2006, almost 99% of their installed capacity came from plants implemented with some sort of incentives.

It is worth to mention that more than 75 % of the Brazil's generation is composed by large hydro and 21 % by thermal power stations (Figure ~~3~~5).

Legend	
CGH	Hydroelectric Generator Center
CGU	Undi-Eletric Generator Center
EOL	Wind Generator Center
PCH	**Small Hydroelectric Power Plant**
SOL	Solar Generation Center Photovoltaic
UHE	Hydroelectric Power Plant
UTE	Thermoelectric Power Plant
UTN	Thermonuclear Power Plant

Figure ~~3~~ 5 - Operational types of project[19] ~~(Source: Banco de Informações de Geração/ANEEL, 2007)~~

[19] Source: Banco de Informações de Geração/ANEEL, 2007

Moreover, in the energy auctions, which took place between 2005 and 2007 from the total of 9,594 MW sold, 5,888 MW (61.3%) will come from fossil fuel fired thermal power plants, from which 2,152 MW come from natural gas and 2,514 MW fuel oil fired thermal power plants, i.e., 22.4% and 26.2% of the total sold respectively (ESPARTA, 2008).

From the Midwest region, the single project not publicly receiving incentives either from CDM or Proinfa, Camargo Côrrea SHP is a Project from ARROSSENSAL – Agropecuária e Industria S.A.[20], a company from Grupo Camargo Côrrea S.A.[21]. Camargo Côrrea is a company with presence in 20 countries and is one of biggest companies in Brazil. In 2007, it had gross revenues of BRL 12.4 billions[22]. According to KPMG do Brasil Report[23], Grupo Camargo Côrrea is the 7th company among 20 with the greatest assets abroad (including hydropower projects). Considering that Grupo Camargo Côrrea has a solid structure, which enables the surpassing of the barriers as described in the PDD, the PPs considered reasonable not to compare their investment capacity with the one from Brennand Group.

In the analysis conducted by Project Participants, there were 50 Small-Hydro-Power-Plants (SHPs) in whole Brazil that started operations from the period of 2004 to 2007, where 21 received CDM incentives and 14 from Proinfa, totalizing 35 projects which received incentives, representing 70% of the total SHPs that started operations in that period.

It is also important to state that the SHP is not close to any load center and, in contrast to most projects in the Southeast and South Brazilian regions, demanded a significant investment in grid connection.

In summary, this project activity is not the business-as-usual scenario in the country where large hydro and natural gas fired thermal power projects represent the majority of new installed capacity added to the SIN. With the financial benefit derived from the CERs, it is anticipated that other project developers would benefit from this new source of revenue and then would decide to develop such projects. CDM has made it possible for some investors to set up their small hydro plants and sell their electricity to the grid.

SATISFIED/PASS – Project is ADDITIONAL

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the selected approved methodology (ACM0002~~, 2007~~) the baseline emission factor ($EF_{grid,CM,y}$) is calculated using the methodological tool "Tool to calculate the emission factor for an electricity system". According to this tool Project Participants shall apply the following six steps to the baseline calculation:

[20] Evidence by ANEEL Resolution nr. 311, dated July 27th, 2004. Available at: <http://www.aneel.gov.br/cedoc/rea2004311.pdf>.

[21] Available at: <http://www.bndes.gov.br/noticias/2005/not112_05.asp>.

[22] Available at: <http://www.camargocorrea.com.br/>.

[23] Available at: <http://www.kpmg.com.br/publicacoes/tax/Multinacionais_Brasileiras_08_portugues.pdf >.

STEP 1 - Identify the relevant electric power system;

STEP 2 - Choose whether to include off-grid power plants in the project electricity system (optional).

STEP ~~2~~ 3 - Select an operating margin (OM) method;

STEP ~~3~~ 4 - Calculate the operating margin emission factor according to the selected method;

STEP ~~4~~ 5 - Identify the cohort of power units to be included in the build margin (BM);

STEP ~~5~~ 6 - Calculate the build margin emission factor;

STEP ~~6~~ 7 - Calculate the combined margin (CM) emissions factor.

- **STEP 1** - Identify the relevant electric power system

According to the tool, "*If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD*".

Considering that the Brazilian DNA has recently published the Resolution nr. 8 issued on 26th May, 2008 that defines the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence this figure will be used to calculate the baseline emission factor of the grid.

- **STEP 2** - Choose whether to include off-grid power plants in the project electricity system (optional).

Project participants choose to follow Option I (Only grid power plants are included in the calculation).

- **STEP ~~2~~ 3** - Select an operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

The Brazilian DNA made available the operating margin emission factor calculated using option c

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– Dispatch data analysis OM. More information of the methods applied can be obtained in the DNA's website (http://www.mct.gov.br/index.php/content/view/4016.html) and vintage will be used in the project activity.

- **STEP** ~~3~~ 4 - Calculate the operating margin emission factor according to the selected method

The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the power units that are actually dispatched at the margin during each hour h where the project is displacing electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

It will be calculated using the below formulae:

$$EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where:

$EF_{grid,OM-DD,y}$ = Dispatch data analysis operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{PJ,h}$ = Electricity displaced by the project activity in hour h of the year y (MWh)

$EF_{EL,DD,h}$ = CO_2 emission factor for power units in the top of the dispatch order in hour h in year y (tCO_2/MWh)

$EG_{PJ,y}$ = Total electricity displaced by the project activity in year y (MWh)

h = Hours in year y in which the project activity is displacing grid electricity
y = Year in which the project activity is displacing grid electricity

As mentioned above the host country's DNA will provide $EF_{EL,DD,h}$ in order to Project Participants to calculate the operating margin emission factor. Hence, this data will be updated annually applying the number published by the Brazilian DNA. For the purpose of estimative the data of the most recent year available in the DNA website will be used.

- **STEP** ~~4~~ 5 - Identify the cohort of power units to be included in the build margin (BM)

The sample group of power units m used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The build margin will also be calculated by the DNA. The number is published in the website (http://www.mct.gov.br/index.php/content/view/4016.html). For the purpose of estimative, the number for the most recent year will be used in the PDD.

- **STEP ~~5~~ 6** – Calculate the build margin mission factor ($EF_{grid, BM, y}$)

The build margin will also be calculated by the DNA. The number is published in the website and for the purpose of estimative the number for the most recent year will be used.

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \qquad \textbf{Equation 1}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$ = CO2 emission factor of power unit m in year y (tCO2/MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

- **STEP ~~6~~ 7** – Calculate the combined margin (CM) emissions factor $EF_{grid, CM, y}$

The combined margin is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} \qquad \textbf{Equation 2}$$

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., w_{OM} = w_{OM} = 0.5). Alternative weights can be used, as long as w_{OM} + w_{BM} = 1, and appropriate evidence justifying the alternative weights is presented.

Baseline emissions are calculated by using the annual generation (project annual electricity dispatched to the grid) times the CO_2 average emission rate of the estimated baseline, as follows:

Monitored project power generation	(MWh)	(A)
Baseline emission rate factor	(tCO_2/MWh)	(B)
(A) x (B)	(tCO_2)	

The emission reductions by the project activity (ER_y) during a given year *y* are the product of the baseline emissions factor ($EF_{grid,CM,y}$, in tCO_2e/MWh) times the net electricity supplied by the project to the grid (EG_y, in MWh), as follows:

$$ER_y = EF_y \cdot EG_y \qquad \textbf{Equation 3}$$

Additionally, according to ACM0002, version 12.~~0~~1, EB 58~~47~~, new hydro electric power projects with reservoirs, shall account for project emissions, estimated as follows:

a) if the power density (*PD*) of power plant is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_y = EF_{\mathrm{Re}} \cdot TEG_y \div 1000$$

Where:

PEy = Emission from reservoir expressed as tCO_2e/year.

EF_{Res} = is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO_2e/MWh.

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).

b) If power density (*PD*) of the project is greater than 10W/m^2, $PE_y = 0$. The power density of the project activity is calculated as follows:

$$PD = (Cap_{PJ} - Cap_{BL})/(A_{PJ} - A_{BL})$$

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.

Indirect emissions can result from project construction, transportation of materials and fuel and other upstream activities. Nevertheless no significant net leakage from these activities was identified.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	Cap_{BL}
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The methodology that this value shall be applied for new hydro power plants.
Any comment:	-

Data / Parameter:	A_{BL}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity.
Source of data used:	Project site
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied:	The methodology that this value shall be applied for new hydro power plants.
Any comment:	-

Data / Parameter:	EF_{Res}
Data unit:	$kgCO_2e/MWh$
Description:	Default emission factor for emissions from reservoirs
Source of data used:	Decision by EB23
Value applied:	90 $kgCO_2e/MWh$
Justification of the choice of data or description of measurement methods and procedures actually applied:	Option 2 of the tool was chosen. Hence. this parameter will be ***ex-post*** up-dated applying the numbers provided by the Brazilian DNA.
Any comment:	-

Data / Parameter:	PLF
Data unit:	%
Description:	Plant load factor
Source of data used:	Document "Portaria MME n 100 (assured energy)", from the Ministry of

	Mines and Energy (copy under request), which informs about assured energy of both plants.
Value applied:	Pampeana 81% ;Terra Santa: 80%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Official information from the Ministry of Mines and Energy.
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

As described in section B.6.1 - Explanation of Methodological Choices, the Brazilian DNA, through its Resolution nr. 8 dated May 26th, 2008, determined the Brazilian electricity system, for the purpose of CDM activities, as a single interconnected system comprehending the five geographical regions of the country (North, Northeast, South, Southeast and Midwest).

Also, the Brazilian DNA made available the build margin and the operating margin emission factors. This last one is calculated using option c – Dispatch data analysis OM. The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the power units that are actually dispatched at the margin during each hour *h* where the project is displacing electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$. More information of the methods applied can be obtained in the DNA's website (http://www.mct.gov.br/index.php/content/view/4016.html). Then, data provided by the Brazilian DNA will be used in the project verification.

Emission reductions (*ER*) in this project are calculated directly from electricity supplied by the project to the grid (*EG*) multiplied by the emission factor (*EF*).

Future electricity supplied by the project to the grid is estimated based on the installed capacity of the hydropower plant and its capacity factor. The estimative of energy generation is presented in the section of the monitored parameters.

For the purpose of ex-ante emission reductions calculation, operating margin and build margin published by the Brazilian DNA for the year 2007, the most recent data, is utilized. For more details please refer to section B.6.1. For the purpose of estimative, the numbers provided by the DNA for the year 2007 were applied. When applying the published numbers in the formula presented in step 3 of section B.6.1. the $EF_{grid,OM-DD,y}$ obtained was:

$$EF_{grid,OM-DD,\,2007} = 0.2476909\ tCO_2e/MWh.$$

The building margin for the year of 2007 published by the DNA is:

$$EF_{BM,2007} = 0.079475\ tCO_2e/MWh.$$

With these numbers, applying in the formula presented in step 6 of section B.6.1., we have:

$EF_{grid,CM,y}$ = 0.5 × 0.2476~~909~~ + 0.5 × 0.0794~~75~~

$EF_{grid,CM,y}$ = 0.1635~~842~~ tCO_2e/MWh.

Also, according to ACM0002, version 12.1~~0~~, EB ~~47~~58, new hydro electric power projects with reservoirs, shall account for project emissions, estimated as follows:

a) if the power density (*PD*) of power plant is greater than 4 W/m^2 and less than or equal to 10 W/m^2:

$$PE_y = EF_{Re} \cdot TEG_y \div 1000$$

Where:

PEy = Emission from reservoir expressed as tCO_2e/year.

EF_{Res} = is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO_2e/MWh.

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).

Considering the data below of the proposed project activity, project emissions have to be considered:

Pampeana SHPP
Installed power = 28 MW
Assured Energy = 22.43[24]
Reservoir area: 4.17 km^2
Power density = 6.71 W/m^2 or 6.71 MW/ km^2

Terra Santa SHPP
Installed power = 27.4 MW
Assured Energy = 21.89 MW[25]
Reservoir area: 6.25 km^2
Power density = 4.38 W/m^2 or 4.38 MW/ km^2

[24] In accordance with MME´s (Brazilian Ministry of Mines and Energy) resolution number 135 of June 25, 2007, available at http://www.mme.gov.br/mme/galerias/arquivos/legislacao/portaria/Portaria_n_135-2007.pdf

[25] Idem Footnote 23.

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Table 13: total energy generation and tCO_2 total estimation reduction of the Pampeana SHPP

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Year	TEGy (MWh)	EG Facility,y (MWh)	PE (tCO2)	Estimated CERs (without PE consideration)	Total estimated CERs (tCO2e)
2011 *	130.991	124.178	11.789	20.303	8.514
2012	196.487	186.267	17.684	30.455	12.771
2013	196.487	186.267	17.684	30.455	12.771
2014	196.487	186.267	17.684	30.455	12.771
2015	196.487	186.267	17.684	30.455	12.771
2016	196.487	186.267	17.684	30.455	12.771
2017	196.487	186.267	17.684	30.455	12.771
2018 **	65.496	62.089	5.895	10.152	4.257
TOTAL	**1.375.408**	**1.303.868**	**123.787**	**213.182**	**89.396**

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Year	TEGy (MWh)	EG Facility,y (MWh)	PE (tCO2)	Estimated CERs (without PE consideration)	Total estimated CERs (tCO2e)
2010 (from May 1st on)	132.451	125.638	11.921	23.142	11.222
2011	198.677	188.457	17.881	34.714	16.833
2012	198.677	188.457	17.881	34.714	16.833
2013	198.677	188.457	17.881	34.714	16.833
2014	198.677	188.457	17.881	34.714	16.833
2015	198.677	188.457	17.881	34.714	16.833
2016	198.677	188.457	17.881	34.714	16.833
2017 (until April 30th)	66.226	62.819	5.960	11.571	5.611
TOTAL	1.390.738	1.319.198	125.166	242.996	117.830

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***From July 1st on**

**** Until June 30th**

Table 8: total energy generation and tCO_2 total estimation reduction of the Pampeana SHPP

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Table 14: total energy generation and tCO_2 total estimation reduction of the Terra Santa SHPP

Year	TEGy (MWh)	EG Facility,y (MWh)	PE (tCO2)	Estimated CERs (without PE consideration)	Estimated CERs (tCO2e)
2010 (from May 1st on)	137.934	131.120	12.414	24.152	11.738
2011	206.901	196.681	18.621	36.229	17.608
2012	206.901	196.681	18.621	36.229	17.608
2013	206.901	196.681	18.621	36.229	17.608
2014	206.901	196.681	18.621	36.229	17.608
2015	206.901	196.681	18.621	36.229	17.608
2016	206.901	196.681	18.621	36.229	17.608
2017 (until April 30th)	68.967	65.560	6.207	12.076	5.869
TOTAL	1.448.305	1.376.765	130.347	253.600	123.253

Year	TEGy (MWh)	EG Facility,y (MWh)	PE (tCO2)	Estimated CERs (without PE consideration)	Total estimated CERs (tCO2e)
2011 *	127.838	121.024	11.505	19.787	8.282
2012	191.756	181.536	17.258	29.681	12.423
2013	191.756	181.536	17.258	29.681	12.423
2014	191.756	181.536	17.258	29.681	12.423

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2015	191.756	181.536	17.258	29.681	12.423
2016	191.756	181.536	17.258	29.681	12.423
2017	191.756	181.536	17.258	29.681	12.423
2018 **	63.919	60.512	5.753	9.894	4.141
TOTAL	**1.342.295**	**1.270.755**	**120.807**	**207.768**	**86.962**

***From July 1st on**

**** Until June 30th**

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~~Table 9: total energy generation and tCO_2 total estimation reduction of the Terra Santa SHPP~~

B.6.4. Summary of the ex-ante estimation of emission reductions:

Table 15: tCO_2 total estimation reduction of the project

	Years	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)
(*)	Year 1 - (2010)	24.335	47.295	0,0	22.960
	Year 2 - (2011)	36.502	70.942	0,0	34.440
	Year 3 - (2012)	36.502	70.942	0,0	34.440
	Year 4 - (2013)	36.502	70.942	0,0	34.440
	Year 5 -(2014)	36.502	70.942	0,0	34.440
	Year 6 -(2015)	36.502	70.942	0,0	34.440
	Year 7 - (2016)	36.502	70.942	0,0	34.440
(**)	Year 8 - (2017)	12.167	23.647	0,0	11.480
	Total (tonnes of CO_2e)	255.514	496.596	0,0	**241.082**

(*) From May 1st on
(**) Until April 30th

Years	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)
Year 1 - (2011)*	23.295	40.091	0,0	16.796
Year 2 - (2012)	34.942	60.136	0,0	25.194
Year 3 - (2013)	34.942	60.136	0,0	25.194
Year 4 - (2014)	34.942	60.136	0,0	25.194
Year 5 -(2015)	34.942	60.136	0,0	25.194
Year 6 -(2016)	34.942	60.136	0,0	25.194
Year 7 - (2017)	34.942	60.136	0,0	25.194
Year 8 - (2018)**	11.647	20.045	0,0	8.398
Total (tonnes of CO_2e)	**244.593**	**420.951**	**0,0**	**176.358**

***From July 1st on**
**** Until June 30th**

~~Table 910: tCO_2 total estimation reduction of the project~~

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1. Data and parameters monitored:

~~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.~~

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.

Data / Parameter:	$EG_{y,\ Pampeana}$
Data unit:	MWh/year
Description:	Net electricity generation of the Project delivered to grid from Pampeana SHPP.
Source of data:	Project activity site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Pampeana SHPP: ~~188,457~~186.267 MWh ~~Terra Santa SHPP: 196,681 MWh~~
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording.
QA/QC procedures to be applied:	Electricity supplied by the project activity to the grid. Double checked by internal control and sales receipt or by Câmara Comercializadora de Energia Elétrica – CCEE evidences. Energy metering QA/QC procedures are explained in ~~Annex 4~~section B.7.2 (the equipments used have by legal requirements extremely low level of uncertainty).
Any comment:	-

Data / Parameter:	$EG_{y,\ Terra\ Santa}$
Data unit:	MWh/year
Description:	Net electricity generation of the Project delivered to grid from Terra Santa SHPP.
Source of data:	Project activity site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Terra Santa SHPP: 181.536 MWh
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording.
QA/QC procedures to be applied:	Electricity supplied by the project activity to the grid. Double checked by internal control and sales receipt or by Câmara Comercializadora de Energia

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	Elétrica – CCEE evidences. Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirements extremely low level of uncertainty).
Any comment:	-

Data / Parameter:	$TEG_{y, Pampeana}$
Data unit:	MWh/year
Description:	Total electricity produced by ~~the project activity~~Pampeana SHPP, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*.
Source of data:	Project activity site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Pampeana SHPP: ~~198,677~~196.487 ~~Terra Santa SHPP: 206,901~~
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording.
QA/QC procedures to be applied:	Electricity supplied by the project activity to the grid. Double checked by internal control. Energy metering QA/QC procedures are explained in ~~Annex 4~~section B.7.2 (the equipments used have by legal requirements extremely low level of uncertainty).
Any comment:	The total electricity produced by the project activity is an operational parameter that must be monitored during the plant´s operation. Regular reports will be consolidated and electronically archived.-

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Data / Parameter:	$TEG_{y, Terra Santa}$
Data unit:	MWh/year
Description:	Total electricity produced by Terra Santa SHPP, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*.
Source of data:	Project activity site.
Value of data applied for the purpose of calculating expected	Terra Santa SHPP: 191.756

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emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording.
QA/QC procedures to be applied:	Electricity supplied by the project activity to the grid. Double checked by internal control. Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirements extremely low level of uncertainty).
Any comment:	The total electricity produced by the project activity is an operational parameter that must be monitored during the plant´s operation. Regular reports will be consolidated and electronically archived.

Data / Parameter:	$Cap_{PJ, Pampeana}$
Data unit:	MW
Description:	Installed capacity of ~~the~~ Pampeana hydro power plant after the implementation of the project activity.
Source of data:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Pampeana SHPP: 28 MW ~~Terra Santa SHPP: 27.4 MW~~
Description of measurement methods and procedures to be applied:	Annexed official document, from the Ministry of Mines and Energy, "Portaria MME n 100 (assured energy)", shows the installed power for both plants, tracked in red.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$Cap_{PJ, Terra Santa}$
Data unit:	MW
Description:	Installed capacity of Terra Santa hydro power plant after the implementation of the project activity.

Source of data:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Terra Santa SHPP: 27.4 MW
Description of measurement methods and procedures to be applied:	Annexed official document, from the Ministry of Mines and Energy, "Portaria MME n 100 (assured energy)", shows the installed power for both plants, tracked in red.
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	$A_{PJ, Pampeana}$
Data unit:	km^2
Description:	Area of ~~the~~Pampeana´s reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Pampeana SHPP: 4.17 ~~Terra Santa SHPP: 6.25~~
Description of measurement methods and procedures to be applied:	The area of the reservoir can be calculated with the topographic map and the water surface height. The first data is obtained through a topographic survey developed at the area; the second is obtained with local measures made at the reservoir during the plant operation. The topographic survey was made for the development of the basic project and the elevation measures will be monitored yearly during the plant operation.
QA/QC procedures to be applied:	QA/QC The topographical measures were made with two high precision GPS receivers (model: TOPCON HIPER) with 3 mm accuracy. After the survey, verification was made by crosschecking the acquired values with an official ANEEL´s public data.
Any comment:	-

Data / Parameter:	$A_{PJ, Terra Santa}$
Data unit:	km^2
Description:	Area of Terra Santa´s reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.

Source of data:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Terra Santa SHPP: 6.25
Description of measurement methods and procedures to be applied:	The area of the reservoir can be calculated with the topographic map and the water surface height. The first data is obtained through a topographic survey developed at the area; the second is obtained with local measures made at the reservoir during the plant operation. The topographic survey was made for the development of the basic project and the elevation measures will be monitored yearly during the plant operation.
QA/QC procedures to be applied:	QA/QC The topographical measures were made with two high precision GPS receivers (model: TOPCON HIPER) with 3 mm accuracy. After the survey, verification was made by crosschecking the acquired values with an official ANEEL´s public data.
Any comment:	-

Data / Parameter:	$EF_{grid\ CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the values published by the Brazilian DNA.
Source of data to be used:	Brazilian DNA website (http://www.mct.gov.br/index.php/content/view/4016.html)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.~~1842~~1635
Description of measurement methods and procedures to be applied:	The selected option to calculate the operating margin was the dispatch analysis which does not permit the vintage of *ex-ante* calculation of the emission factor. Hence, this value will be calculated annually applying the numbers published by the Brazilian DNA and following the steps provided in the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$EF_{grid\ OM,,y}$
Data unit:	tCO_2/MWh
Description:	Operating margin CO_2 emission factor for grid connected power generation in

	year *y* calculated using the values published by the Brazilian DNA.
Source of data to be used:	Brazilian DNA website (http://www.mct.gov.br/index.php/content/view/4016.html)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.2476909
Description of measurement methods and procedures to be applied:	The selected option to calculate the operating margin was the dispatch analysis which does not permit the vintage of *ex-ante* calculation of the emission factor. Hence, this value will be calculated annually applying the numbers published by the Brazilian DNA and following the steps provided in the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$EF_{grid\ BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor for grid connected power generation in year *y* calculated using the values published by the Brazilian DNA.
Source of data to be used:	Brazilian DNA website (http://www.mct.gov.br/index.php/content/view/4016.html)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0799475
Description of measurement methods and procedures to be applied:	The selected option to calculate the operating margin was the dispatch analysis which does not permit the vintage of *ex-ante* calculation of the emission factor. Hence, this value will be calculated annually applying the numbers published by the Brazilian DNA and following the steps provided in the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures to be applied:	
Any comment:	

B.7.2. Description of the monitoring plan:

As of the procedures set by the "Approved consolidated monitoring methodology ACM0002" – "Consolidated methodology for grid-connected electricity generation from renewable sources", version 120 (20092010).

It consists in using meter equipment projected to registry and verifies bidirectionally 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.

The project will proceed with the necessary measures for the power control and monitoring. Together with the information produced by both ANEEL and ONS, it will be 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 the Chamber of Electric Energy Commercialization CCEE (from the Portuguese *Câmara de Comercialização de Energia Elétrica*). CCEE makes feasible and regulates the electricity energy commercialization.

There will be four energy meters specified by CCEE. Each SHPP will have a meter and there will be two meters (principal and backup), model SL7000, utilized for billing from Centrais Elétricas Matogrossenses S/A.. Before the operations start, CCEE demands that these meters are calibrated by an entity with Rede Brasileira de Calibração (RBC) credential. Measurements will be controlled in real time by the Operation and Management Center (COG) in Cuiabá, capital of Mato Grosso state. Measurement data will be compared between the meters, so that any problems can be detected. In case of any problem, plant personnel will be put in action.

Meters model SL7000, used for EGy measurement, are bidirectional. The measurement is carried out at the output of the 138 KV transmission line for each plant and it is redundant, so that, in case the first meter fails, the second automatically replaces it. There are no transmission losses to be considered, since measurements are carried out at the output of the 138 KV transmission line for each plant.

The Total electricity produced by both plants will be monitored by an energy meter (model IDM 144, manufactured by ABB, accuracy 0.5%) located at the powerhouse of Pampeana SHPP and Terra Santa SHPP at the output terminal of each generator. All measurements will be consolidated in internal reports based on hourly measurement.

Brennand Group will be responsible for the calibration (every 2 years) and maintenance of the monitoring equipment, for dealing with possible monitoring data adjustments and uncertainties, for review of reported results/data, for internal audits of GHG project compliance with operational requirements and for corrective actions.

Brennand is responsible for the project management, as well as for organising and training of the staff in the appropriate monitoring, measurement and reporting techniques. Also, Brennand is preparing an operation, maintenance and emergency manual. Technicians will be trained on mounting and start-up.

ANEEL can visit the plant to inspect the operation and maintenance of the facilities.

Brennand Group, the company that controls Pampeana Energética Ltda. and Várzea do Jubá Energia Ltda., has hired expert companies to execute their environmental programs. After the beginning of the commercial operations, renovation of degraded areas and of permanent preservation areas will be done according to the regulations of the environmental agencies, through a team of environment experts, that will also monitor the compliance with the environmental agencies' regulations. Studies done during the design phase of the project activities have shown the environmental impacts and the interference on the social development in the region of the plant, indicating the mitigation measures to be adopted during the construction phase. These measures are being taken rigorously. Data about environmental impact are being archived by the SHPPs and the environmental agencies.

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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.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date of completing the final draft of this baseline section and the monitoring methodology (DD/MM/YYYY): ~~11~~18/~~09~~11/20~~08~~10.

Name of person/entity determining the baseline:

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Ecopart Assessoria em Negócios Empresariais Ltda. is Project Advisor and Project Participant.

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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

~~18~~01/~~05~~07/2006 (purchase of main equipments such as generators, turbines and related technical parts~~issuance of construction permit for Terra Santa~~)

~~The CDM glossary of terms defines the starting date of a non A/R project activity as "the earliest date at which either the implementation or construction or real action of a project activity begins".~~

~~From the dates informed in section B,5, the first real action was on 18/05/2006 when Várzea do Jubá Energia Ltda (Terra Santa). received the Construction License from the Mato Grosso Environmental Agency.~~

C.1.2. Expected operational lifetime of the project activity:

25y-0m

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/0~~1~~7/201~~0~~1 or on the date of registration of the CDM project activity, whichever is later.

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

In Brazil, the sponsor of any project that involves construction, installation, expansion or operation of any polluting or potentially polluting activity or any other capable to cause environmental degradation is obliged to secure a series of permits from the relevant environmental agency (federal and/or local, depending on the kind of project and location).

The environmental impact of the Project is considered small by the host country definition of small-hydro plants. By legal definition of the Brazilian Electricity Regulatory Agency (ANEEL), Resolution no. 652, December 9th, 2003, small hydro in Brazil must have installed capacity greater than 1 MW but not more than 30 MW and with reservoir area less than 3 km², but not greater than 13 km².

Although small hydro projects has reduced environmental impacts given the smaller dams and reservoir size, project sponsors have to obtain all licenses required by the Brazilian environmental regulation (Resolution CONAMA - *Conselho Nacional do Meio Ambiente* (National Environmental Council) n° 237/97):

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- The preliminary license (*Licença Prévia* or LP),

- The construction license (*Licença de Instalação* or LI); and
- The operating license (*Licença de Operação* or LO).

The environmental permit process has an administrative nature and was implemented by the National Environmental Policy, established by the Law n. 6938 dated on October 31st, 1981. Additionally, other norms and laws were issued by CONAMA and local state agencies.

In order to obtain all environmental licenses every small hydro projects shall mitigate the following impacts:

- Inundation of Indian lands and slaves historical areas – the authorization for that depends on National Congress decision;
- Inundation of environmental preservation areas, legally formed as National Parks and Conservation Units;
- Inundation of urban areas or country communities;
- Reservoirs where there will be urban expansion in the future;
- Elimination of natural patrimony;
- Expressive losses for other water uses;
- Inundation of protected historic areas; and
- Inundation of cemeteries and other sacred places.

The process starts with a previous analysis (preliminary studies) by the local environmental department. After that, if the project is considered environmentally feasible, the sponsors have to prepare the Environmental Assessment, which is basically composed by the following information:

- Reasons for project implementation;
- Project description, including information regarding the reservoir;
- Preliminary Environmental Diagnosis, mentioning main biotic, and anthropic aspects;
- Preliminary estimation of project impacts; and
- Possible mitigating measures and environmental programs.

The result of those assessments is the Preliminary License (LP), which reflects the environmental local agency positive understanding about the environmental project concepts.

In order to obtain the Construction License (LI) it is necessary to present (a) additional information about previous assessment; (b) a new simplified assessment; or (c) the Environmental Basic Project, according to the environmental agency decision informed at the LP.

The Operation License (LO) is a result of pre-operational tests during the construction phase to verify if all exigencies made by environmental local agency were completed.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

For the issuance of the Constructions Licenses, the Mato Grosso Environmental Agency requested the fulfillment of the following programs for Pampeana and Terra Santa SHPPs Projects, also mentioned in the Environmental Program Report of the Projects:

- Reservoir cleaning;
- Silvestre fauna and flora rescue (terrestrial and aquatic);
- Fauna and flora monitoring;
- Reforestation;
- Quality of water monitoring;
- Erosion control;
- Degraded area recuperation;
- Environmental education;
- Archaeological monitoring.

Pampeana and Terra Santa plants possesses construction license nr. 1070/2006 and nr. 360/2006 issued by the Mato Grosso Environmental Agency (SEMA – Secretaria do Estado do Meio Ambiente) on 16th February, 2007 and 18th May, 2006 This licenses was valid until 16th December, 2008 and 18th May, 2009 respectively.

The project does not imply in significant negative transboundary environmental impacts, on the contrary the licenses would not be issued. All documents related to operational and environmental licensing are public and can be obtained at the state environmental agency (SEMA) and with the project participants.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

Brazilian Designated National Authority, "*Comissão Interministerial de Mudanças Globais do Clima*", request comments for local stakeholders, and the validation report issued by an authorized DOE according to the Resolution nr. 1, issued on 11th September 2003, in order to provide the letter of approval.

The Resolution determines the direct invitation for comments sent by the project proponents at least to the following agents involved in and affected by project activities and at least 15 days before the GSP:

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- Municipal governments and City Councils;
- State and Municipal Environmental Agencies;
- Brazilian Forum of NGOs and Social Movements for Environment and Development;
- Community associations;
- State Attorney for the Public Interest (state and federal).

Invitation letters were sent to the following agents – by postal – on April 16th, 2008:

- City Hall of Tangará da Serra and Barra dos Bugres;
- Municipal Assembly of Tangará da Serra and Barra dos Bugres;
- Environmental Agency of Tangará da Serra and Barra dos Bugres;
- Communitarian Association of Tangará da Serra and Barra dos Bugres (Associação Comercial e Industrial de Tangará da Serra and APAE – Associação de Pais e Amigos dos Excepcionais);
- State Environmental Agency (*SEMA – Secretaria do Estado do Meio Ambiente);*
- State Attorneys for the Public Interest of Brazil and Mato Grosso state;
- Fórum Brasileiro de ONGs e Movimentos Sociais para o Desenvolvimento e Meio Ambiente (Brazilian Forum of NGOs and Social Movements for the Development and Environment).

Copies of the letters and post office confirmation of receipt are available upon request and were submitted to the DOE during the validation of the Project Activity.

No concerns were raised in the public calls regarding the project neither in the local (demanded by the DNA) nor in the global stakeholders' process (demanded by the CDM modalities and procedures).

E.2. Summary of the comments received:

FBOMS sent a letter suggesting the use of Gold Standard or similar tools.

E.3. Report on how due account was taken of any comments received:

Project participants consider that requests made by the Brazilian Government are sufficient to be used as sustainable indicators which are attended by this CDM project activity.

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Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

This project is not a diverted ODA from an Annex 1 country.

Annex 3

BASELINE INFORMATION

The Brazilian electricity system, for the purpose of CDM activities, was delineated as a single interconnected system comprehending the five geographical regions of the country (North, Northeast, South, Southeast and Midwest). This was determined by the Brazilian DNA trough its Resolution nr. 8 issued on 26th May, 2008.

More information is available at the Brazilian DNA website
<http://www.mct.gov.br/index.php/content/view/3881.html>

BUILD MARGIN	
	Average Emission Factor (tCO_2/MWh) - **ANNUAL**
2009	
	To be published in the beginning of 2010

OPERATING MARGIN												
Average Emission Factor (tCO_2/MWh) - **MONTHLY**												
2009	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.2813	0.2531	0.2639	0.2451	0.4051	0.3664	0.2407	0.1988	0.1622	0.1792	0.1810	0.1940

~~(http://www.mct.gov.br/index.php/content/view/4016.html).~~

Annex 4

MONITORING INFORMATION

Methodology applicable to this project is the approved consolidated monitoring methodology ACM0002, version 12.10, 2009 2010 – "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources". More information can be seen at section B.7.2 – Description of the monitoring plan.

Monitoring QA/QC procedures are informed in section B.7.2.

Annex 5

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