CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Rialma Companhia Energética III S/A. – Santa Edwiges III Small Hydro Power Plant – Small Scale CDM Project.

PDD version number: 14.b

Date (DD/MM/YYYY): 01/06/2009.

The only changes made to this version of the PDD compared to previous (version 14 dated 31/07/2008) referred to in the Brazilian Letter of Approval issued on August 6th, 2008 are related to the review requested by the CDM Team/UNFCCC Secretariat after the completeness check (request received on 09/12/2008; all changes made are highlighted in section C.1.1) and request for review and review processes (requests received on 12/02/2009 and 26/03/2009, respectively; changes made are highlighted in section B.5.)[1].

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

The primary objective of Santa Edwiges III Small Hydro Power Plant 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[2].

Santa Edwiges III Small Hydro Power Plant consists of a run-of-river small-hydro power plant (11.6 MW), that has a small reservoir (0.64 km²) with minor environmental impact.

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[1] During its 47th meeting the Executive Board decided to register the proposed project activity "*subject to satisfactory corrections (…) if the project participant and DOE (TÜV-SÜD) submit a revised PDD and the corresponding validation report which incorporate the information provided in the response to the review regarding the assessment of the investment analysis for tariff and total investment*" (paragraph 82n of the meeting report available at <http://cdm.unfccc.int/EB/047/eb47rep.pdf>). To ensure all information provided during the review process is included in the PDD, Project Participants' comments to the request for review and review of the project activity, in their original format, are also attached in the end of this document.

[2] 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.*"

The region where the small hydro power plant is located is at the end of a grid, consequently it is more susceptible to blackouts. The plant will contribute with an already existing grid (from Formosa to Alvorada do Norte, from Iaciara to Alvorada do Norte and from Posse to Alvorada do Norte), relieving it. In addition, new industries will be able to come to the region where the project is located, contributing to the development of the area.

Rialma Companhia Energética III S/A is the owner of Santa Edwiges III. The company was originated from a split in Rialma S/A Centrais Elétricas Rio das Almas, in order to specifically administrate Santa Edwiges III activities.

The project is located in the Midwest of Brazil, in the Buritis River, between Mambaí and Buritinópolis cities, state of Goiás, at the intersection of longitude 46º 17'29'' W and latitude 14º 22' 18''S, about 300 Km from Brasília (Federal District).

Mambaí and Buritinópolis are cities with 5,397 and 3,590 inhabitants respectively (IBGE, 2006). Mambaí, which is considered the poorest city in the state, has 62.36% of its population living in the urban area; in Buritinópolis 51.20% of its population live in rural area.

The Santa Edwiges III Small Hydro Power Plant Project improves the supply of electricity with clean, renewable hydroelectric power while contributing to the regional/local economic development. Small-scale hydropower run-of-river plants provide local distributed generation, in contrast with the business as usual large hydropower and natural gas fired plants built in the last 5 years, and these small-scale projects provide site-specific reliability and transmission and distribution benefits including:

- increased reliability and shorter and less extensive outages;
- lower reserve margin requirements;
- improved power quality;
- reduced lines losses;
- reactive power control;
- mitigation of transmission and distribution congestion; and
- increased system capacity with reduced T&D investment.

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. Santa Edwiges III Small Hydro Power Plant uses the renewable hydro potential of the Buritis River to supply electricity to a distribution system which is the Brazilian South-Southeast-Midwest interconnected grid.

It can be said that fair income distribution is achieved from job creation and an increase in people's wages, however better income distribution in the region where the Santa Edwiges III Project is located is obtained mainly from less expenditures and more income in the local municipalities. The surplus of capital that these municipalities will have could be translated into investments in education and health, which will directly benefit the local population and indirectly impact a more equitable income distribution. The lower expenditure is generated due to the fact that money will no longer be spent in the same amount to "import" electricity from other regions in the country through the grid. This money would stay in the region and be

used for providing the population better services, which would improve the availability of basic needs, and avoid emigration. The local population will receive economic benefits from royalties paid to the municipalities for the water rights granted to Santa Edwiges III Small Hydro Power Plant.

A.3. Project participants:

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)	Rialma Companhia Energética III S.A. (Private)	No
	Ecoinvest Carbon Brasil 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.		

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 small-scale project activity:

The Santa Edwiges III Small Hydro Power Plant project uses water from Buritis River to generate electricity, with an 11.6 MW installed capacity. SHPP Santa Edwiges III facility contains a small dam (reservoir area 0.64 km^2), which stores water in order to generate electricity for short periods of time. Run-of-river projects 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).

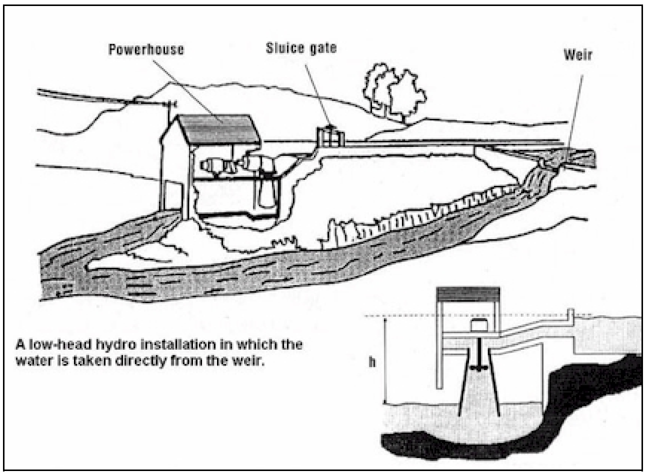


Figure 1- Schematic view of run-of-river power plant

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 Santa Edwiges III 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.

To determine the river’s dry season flow rate, data provided by Aneel indicating monthly average river flow at the project activity location from 1930 to 1999 was used (Table 2).

Table 2 - Buritis’ river monthly average flow at the project location

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average 1930 to 1999 (m^3/s)	27.1	26.9	25.8	23.8	21.9	21.0	20.6	20.7	21.2	23.0	24.6	27.4

The dry season in the region is from May to October. With the numbers in the above table the average dry season flow rate is *21.4 m^3/s*.

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.”*

- Maximum volume of the dam: 5,591,700 m^3
- Dry season average flow rate: 21,4 m^3/s
- Days of poundage at maximum volume of the dam: 3,02 days

Then, to the understanding or the project participants, the Santa Edwiges III Small Hydro Power Plant can be considered a run-of-river power plant according to all the presented criteria.

The technology employed at Santa Edwiges III Small Hydro Power Plant project is established in the industry. The Francis turbine (Figure 2) is the most widely used among water turbines. In this project, the turbine is produced in Brazil with a Swedish technology that improves its efficiency. This turbine is a type of hydraulic reactor 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 volute casing and is directed onto the blades by wicket gates. The low momentum water then exits the turbine through a draft tube. In the model, water flow is supplied by a variable speed centrifugal pump. A load is applied to the turbine by means of a magnetic brake, and torque is measured by observing the deflection of calibrated springs. The performance is calculated by comparing the output energy to the energy supplied.

Figure 2 - Example of a Francis turbine

(Source: HISA, http://www.hisa.com.br/produtos/turbinas/turbinas.htm)

The technology and equipment used in the project were developed and manufactured locally and has been successfully applied to similar projects in Brazil and around the world (Table 3).

Table 3 - Specifications of the equipment used at Santa Edwiges III Small Hydro Power Plant[3]

Turbines	
Manufacturer	Not established yet
Type	Francis
Quantity	2
Power (MW)	5.8
Total Installed Capacity (MW)	11.6
Generators	
Manufacturer	WEG Equipamentos Elétricos S/A
Model	SPA 1250
Excitation System	BRUSHLESS
Quantity	2
Power (kVA)	6,300
Voltage (V)	6,900

In addition to the characteristics mentioned above, the SHPP posses a 30.20m gross waterfall and 29.00 m net waterfall, according to the basic project. And the annual average flow rate of the river is 23.7 m^3/s.

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Brazil

[3] The specifications of the equipment used in Santa Edwiges III were taken from the manufactures' proposals.

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

State of Goiás (Midwest of Brazil).

A.4.1.3. City/Town/Community etc:

Mambaí and Buritinópolis

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project is located in the Midwest of Brazil, state of Goiás, cities of Mambaí and Buritinópolis (Figure 3), and uses the hydro potential of the Buritis River. The exact address of Santa Edwiges III Small Hydro Power Plant is Rodovia GO108, 08 km.

Santa Edwiges III is between the intersection of the following geographic coordinates:

Location at the project site	*Latitude*	*Longitude*
Dam	14°22'18''S	46°17'29''W
	14°22'14''S	46°17'28''W
	14°22'16''S	46°17'28.5''W
Power House	14°22'16.3''S	46°17'32.43''W

Figure 3 - Political division of Brazil showing the state of Goiás (Source: Portal Brasil, 2006) and the cities involved in the project activity (Source: City Brazil, 2006).

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Small-scale project activity.

Type 1: Renewable energy projects.

Category I.D.: Grid connected renewable electricity generation.

Version: 12 from July 27, 2007.

Santa Edwiges III Small Hydro Power Plant uses the renewable hydro potential of the Buritis River to supply electricity to a distribution system (Brazilian South-Southeast-Midwest interconnected grid) and has an installed capacity of 11.6 MW (below the eligibility limit of 15 MW for small scale projects). The equipment used in the project was developed and manufactured in Brazil.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Table 4 - Project Emission Reductions Estimation

Years	Annual estimation of emission reductions [tCO_2e]
2009 (from 1st January)	24,001
2010	24,001
2011	24,001
2012	24,001
2013	24,001
2014	24,001
2015 (Until 31st December)	24,001
Total estimated reduction (tCO_2e)	**168,007**
Total number of crediting years	7
Annual average over the crediting period of estimated reduction (tCO_2e)	24,001

A.4.4. Public funding of the small-scale project activity:

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

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM projects activities debundling is defined as the fragmentation of a large project activity into smaller parts.

A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

· With the same project participants;

· In the same project category and technology/measure; and

· Registered within the previous 2 years; and

· Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

Since Santa Edwiges III Small Hydro Power Plant Project does not correspond to all of the above-mentioned points, it shall not be considered debundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology

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

AMS – I.D - Grid connected renewable electricity generation. (Version 12, July 27th, 2007).

According to approved methodology AMS-1.D, a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) shall be calculated in a transparent and conservative manner according to the procedures prescribed in the approved methodology ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 6, May 19th,2006).

B.2 Justification of the choice of the project category:

Category I.D – Renewable energy technologies that supply electricity to a grid.

This is a type I small-scale CDM project activity: a renewable energy project activity with a maximum output capacity equivalent to up to 15 megawatts.

The project activity consists of a run-of-river small-hydro power plant. Thus, the project activity does not consist of a combined heat and power (co-generation) system. The capacity of the proposed project activity is the maximum output capacity of Santa Edwiges III Small Hydro Power Plant, which corresponds to 11.6 MW, and which will not increase beyond 15 MW. The electricity generated by Santa Edwiges III will be dispatched into the Brazilian South-Southeast-Midwest interconnected grid

B.3. Description of the project boundary:

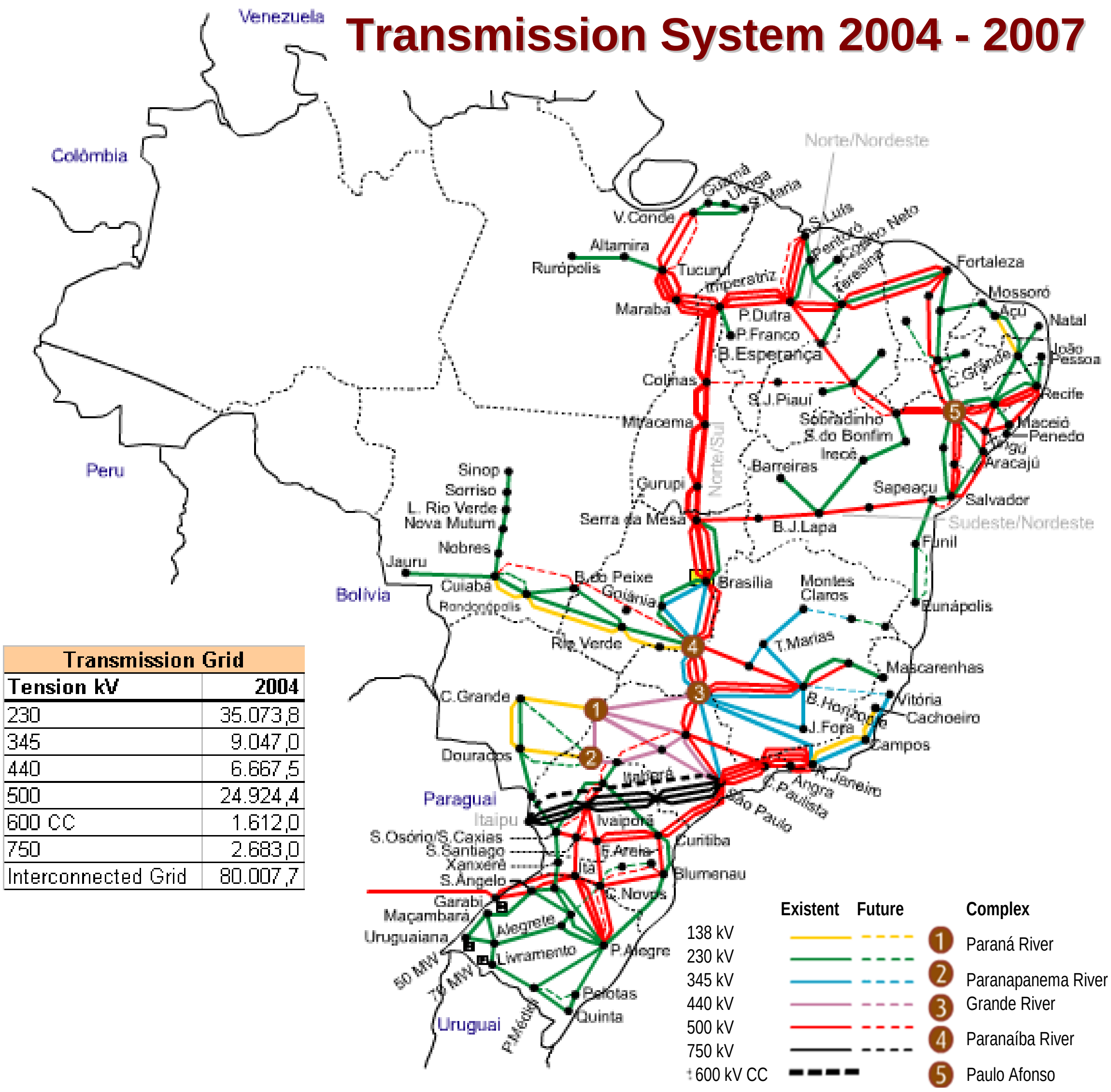
The Santa Edwiges III Project boundaries are defined by the emissions targeted or directly affected by the project activities, construction and operation. It encompasses the physical, geographical site of the hydropower generation source, which is represented by the Buritis River basin close to the power plant facility and the interconnected grid.

Brazil is a large country and is divided in five macro-geographical regions, North, Northeast, Southeast, South and Midwest. The majority of the population is concentrated in the regions South,

Southeast and Northeast. Thus the energy generation and, consequently, the transmission are concentrated in three subsystems. The energy expansion has concentrated in three specific areas:

- Northeast: The São Francisco River basically supplies the electricity for this region. There are seven hydro power plants at the river with total installed capacity around 10.5 GW.
- South/Southeast/Midwest: The majority of the electricity generated in the country is concentrated in this subsystem. These regions also concentrate 70% of the GDP generation in Brazil. There are more than 50 hydro power plants generating electricity for this subsystem.
- North: 80% of the Northern region is supplied by diesel. However, in the city of Belém, capital of the state of Pará where the mining and aluminum industries are located, electricity is supplied by Tucuruí, the second biggest hydro plant in Brazil.

The boundaries of the subsystems are defined by the capacity of transmission. The transmission lines between the subsystems have a limited capacity and the exchange of electricity between those subsystems is difficult. The lack of transmission lines forces the concentration of the electricity generated in each own subsystem. Thus the South-Southeast-Midwest interconnected subsystem of the Brazilian grid (Figure 4) where the project activity is located is considered as a boundary.



Transmission Grid	
Tension kV	2004
230	35.073,8
345	9.047,0
440	6.667,5
500	24.924,4
600 CC	1.612,0
750	2.683,0
Interconnected Grid	80.007,7

Figure 4 - Brazilian Interconnected System (Source: ONS, http://www.ons.org.br/)

Part of the electricity consumed in the country is imported from other countries. Argentina, Uruguay and Paraguay supply a very small amount of the electricity consumed in Brazil. In 2003 around 0.1% of the electricity was imported from these countries. Actually, in 2004 Brazil exported electricity to Argentina that was in a shortage period. So the energy imported from other counties does not affect the boundary of the project and the baseline calculation.

B.4. Description of baseline and its development:

Since the federal government launched in the beginning of the year of 2000 the Thermoelectric

Priority Plan and vast reserves of natural gas were discovered in the Santos Basin in 2003 the policy of using natural gas to generate electricity remains a possibility and it will continue to generate interest from private-sector investors in the Brazilian energy sector.

On the other hand, most if not all-hydro resources in the South and Southeast of the country have been exploited and most of the remaining reserves are located in the Amazon basin, far from the industrial and population centers (OECD, 2001). Considering this, the baseline scenario is the continuation of the current situation of electricity supplied by large hydro and thermal power stations. For more details, please refer to section B.5.

The project will have an installed capacity of 11.6 MW, hence this is a small-scale CDM project and the Simplified M&P for Small-Scale CDM Project Activity, Category I. D. is applicable.

According to approved methodology AMS-1.D, a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) shall be calculated in a transparent and conservative manner according to the procedures prescribed in the approved methodology ACM0002.

According to the selected approved methodology (ACM0002, version 6 from 19 May, 2006), the baseline emission factor (EF_y) is calculated as a combined margin (*CM*), consisting of the combination of operating margin (OM) and build margin (BM) factors. For the purpose of determining the build margin and the operating margin emission factors, a project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. Similarly a connected electricity system is defined as an electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints.

From ACM0002, a baseline emission factor (*EFy*) is calculated as a combined margin (*CM*), consisting of the combination of operating margin (*OM*) and build margin (*BM*) factors according to the following three steps:

- **STEP 1 -** Calculate the operating margin emission factor(s), based on one of the following methods
    - Simple operating margin
    - Simple adjusted operating margin
    - Dispatch data analysis operating margin
    - Average operating margin.

The second alternative, simple adjusted operating margin, will be used here.

The simple adjusted operating margin emission factor ($EF_{OM,adjusted,y}$ in tCO_2/MWh) is a variation on the simple operating margin, where the power sources (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (*j*):

$$EF_{OM,simple-adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \cdot \frac{\sum F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}} \qquad \textbf{Equation 1}$$

Where:

- λ_y is the share of hours in year *y* (in %) for which low-cost/must-run sources are on the margin.

- $\sum_{i,j} F_{i,j,y}$ is the amount of fuel *i* (in mass or volume unit) consumed by relevant power sources *j* (analogous for sources *k*) in year(s) *y*,
- $COEF_{i,j}$ is the CO_2e coefficient of fuel *i* (tCO_2e/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources *j* (analogous for sources *k*) and the percent oxidation of the fuel in year(s) *y* and,
- $\sum_{j} GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j* (analogous for sources *k*),

- **STEP 2** – Calculate the build margin mission factor ($EF_{BM,y}$) as the generation weighted average emission factor (tCO_2e/MWh) of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$ **Equation 2**

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method (ACM0002, 2006) for plants *m*, based on the most recent information available on plants already built . The sample group m consists of either:

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use from these two options that sample group that comprises the larger annual generation.

- **STEP 3** – Calculate the baseline emission factor EF_y, as the weighted average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$ **Equation 3**

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.

The baseline emission factor is calculated in section B.6.1.

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 small-scale CDM project activity:

The project fulfils all the “additionality” prerequisites (see application of the “tool for the demonstration and assessment of additionality[4]”, hereafter referred to simply as “additionality tool,” below) demonstrating that it would not occur in the absence of the CDM.

The “additionality tool” shall be applied to describe how the anthropogenic emissions of GHG are reduced below those that would have occurred in the absence of the Santa Edwiges III Project. The additionality tool provides a general step-wise framework for demonstrating and assessing additionality. These steps, numbered from 1 to 4, include:

1) Identification of alternatives to the project activity;
2) Investment analysis to determine that the proposed project activity is not the most economically or financially attractive;
3) Barrier analysis; and
4) Common practice analysis

The application of the additionality tool to the Santa Edwiges III Project follows.

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 are two-sided analysis, taking into consideration the perspective of the project owner and the perspective of the country.

From the project owner’s perspective, the alternative to the project activity is the implementation of the proposed project activity, dispatching electricity to the grid but not being registered as a CDM project activity. Rialma focus its business I renewable energy. Hence, “the construction of fossil fuel thermal power plants” is not a real alternative from the project owner perspective. In addition, Rialma has already worked on two other SHPPs and has the know-how of operating them. As a consequence “the construction of other renewable power plants” differing from what is being done is not concrete.

From the country’s perspective, the alternative for producing a similar amount of energy, as the one Santa Edwiges III is to provide, would be to use current generation system, which is electricity supplied by large hydro and thermal power stations. Brazil is increasingly depending on thermal plants (mainly natural gas fired).

During a period of restructuring the entire electricity market, as is the current Brazilian situation, investment uncertainty is the main barrier for small renewable energy power projects. These projects must compete with thermal plants, which usually attract the attention of financial investors.

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

Both the project activity and the alternatives scenarios are in compliance with all applicable regulations.

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[4] *Tool for the demonstration and assessment of additionality.* UNFCCC, EB 36, Version 4.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

Additionality is demonstrated through an investment benchmark analysis (option III). 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.

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

Financial indicator identified for Santa Edwiges III project activity is the project IRR, and the benchmark is derived from the company internal benchmark (weighted average capital cost of the company - WACC). A second third-party benchmark identified is the minimum return considered by Brazilian Federal Government at the decision of Proinfa program launch.

Calculation of the Weighted Average Cost of Capital (WACC)

The rate used to discount the business cash flow is also known as the weighted-average cost of capital (WACC) and converts the future cash flow into a present value to all investors, considering that both creditors and shareholders expect compensation towards the opportunity cost of investing resources in an specific business instead of investing such resources in another business of equivalent risk.

The basic principle to be followed when calculating the WACC is consistency with the valuation method and with the definition of the discounted cash flow. The formula used to estimate the company's WACC after taxes is:

$$WACC = [(Kd \times (1-t) \times Pd)+(Ke \times (1-Pd))]$$

Where,

WACC= Weighted-average cost of capital
Kd= Cost of Debt (third-party capital)
t = Marginal corporate income tax
Pd= Debt as a percentage of total capitalization
Ke= Cost of Equity (own capital)

Considering that Santa Edwiges III is being financed with their own capital and other debtors, we have adopted the case of a leveraged company to calculate the firm's WACC. Cost of debt is 17.5% per year and consists of a blended cost of borrowing from short term debt and BNDES financing, as follows:

- CDI = 20%a.a.
- BNDES = 10% + 4%a.a
- Corporate Finance = 36%a.a

The financing line of BNDES for renewable technologies cover approximately 80% of the costs of the equipments. Because of the other costs involved in the project activity (basic project, land acquisition, construction, operation, maintenance) the line offered to Rialma covers 67.51% (sixty seven percent and fifty one) of the project. Therefore, Pd is 67.51%. Rialma provided the other 32.49% (thirty two percent and forty nine). The average of the marginal corporate income tax is 17% per year.

Estimating the Cost of Equity (Ke) was possible by using the parameters observed in global financial markets, allowing the application of the CAPM model. Given these assumptions, the cost of capital in Brazil

should be close to a global cost of capital adjusted for local inflation and capital structure. It should be noted that as far as calculating the inflation differential we have used an estimate of the compounded difference between the local inflation rate and the US inflation rate over ten years. Also, for calculation purposes, we have used a Beta, which measures systemic equity risk within the company's industry, typical of the environmental services sector. Thus, in order to calculate Santa Edwiges' cost of equity we have used the following parameters[5]:

Cost of Equity – Santa Edwiges III		
Yield of Sovereign 15-year BB Debt[6]	**Plus**	12%p.a.
10-year BB Credit risk premium over US Treasuries[7]	**Minus**	2.5%p.a.
10-year US/Brazil inflation differential	**Plus**	5%p.a.
International Market Equity Risk Premium[8]	**Plus**	8,7%p.a.
Adjustment of Market Equity Risk with Beta of 0[9]	**Minus**	0%p.a.
Cost of Equity with Brazilian Country Risk		23.3%p.a.

Applying Ke=23.3% to the formula below:

WACC = [(17.5% x (1 - 17%) x 67.51% + (23.3%p.a. x 32.49%)] = 17.4%p.a.

Thus, Santa Edwiges' Weighted Average Cost of Capital is equal to 17.4%p.a., and this figure will be used to discount the company's cash flow throughout this study.

Financial Indicator, Internal rate of return (IRR)

Santa Edwiges' cash flow, as presented to DOE, shows that the IRR of the project without CERs, 14.70%, is lower than the WACC 17.4%. This evidences that project activity is not financially attractive to investor.

In addition, there is another financial indicator that is worth mention. In order to implement the PROINFA program, the Mines and Energy Ministry (from Portuguese *Minitério de Minas e Energia*) has developed several actions, of which established the parameters to calculate the economic value of projects willing to participate on the program. The Decree n.º 5.025, from 2004, mention this parameters and the government has indicated that the minimum attractiveness tax to be considered in a energy project is 14,89%[10]. Thus considering this value, the project activity can not be considered an attractive option.

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[5] Copeland et al.; Measuring and Managing the Value of Companies; Third Edition.

[6] National Treasury Secretariat. Debt Report, May, 2007. Available at http://www.stn.fazenda.gov.br/

[7] Source: Bloomberg, average second semester of 2004.

[8] http://pages.stern.nyu.edu/~adamodar/pdfiles/country/ERP.pdf

[9] There is not a weighted average of the Beta for Small Hydro Power Plants listed in the Bovespa.

[10] *Valor Econômico da Tecnologia Específica da Fonte (VETEF)* from PROINFA program.

Sub-step 2d: Sensitivity analysis

The sensibility 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. Hence, any variation only can be done increasing project's revenues (sale of electricity), reducing financing expenses and reducing operation and maintenance costs.

Project revenues can increase in two ways: increasing the quantity of electricity generated by the plant or increasing the price paid for electricity. An increase in energy generation is not expected to happen because the electricity generation estimative is based on the assured energy established by ANEEL (ANNEL Resolution nr 28 dated October 23rd, 2007). This number is established based on hydrological data of the river, considering several years. In conclusion the energy generation of the plant is not expected to increase. In this sense, only the possible increase in the price of electricity has to be evaluated.

The original project's IRR was calculated considering the energy price of BRL 133.62/MWh. This price was taken from similar projects that signed long term PPAs with the utility company – Celg (*Centrais Elétricas de Goiás*). The IRR obtained when considering this price was equal to 14.70%. The benchmark used to evaluate the probability of variation in the energy price was the one observed in the government's auction.

According to the Chamber of Electrical Energy Commercialization (CCEE – *Câmara de Comercialização de Energia Elétrica*) *the criterion of the least tariff is used to define the winners of a given auction, that is, the winners of the auction shall be those bidders which offer electric power for the least price per Mega-Watt Hour to supply the demand envisaged by the Distributors*.

Two public actions were carried out in 2007 by the time of the project start date by the Brazilian Chamber of Electrical Energy Commercialization (CCEE, from the Portuguese "*Câmara de Comercialização de Energia Elétrica*") for electricity to be dispatched from 2010 onwards. An introduction to the role of the CCEE in the Brazilian power sector follows:

> *In 2004, Law 10.848 implemented the New Model for the Power Sector and authorized the creation of the Electric Power Commercialization Chamber – CCEE – which is regulated by Decree 5.177, dated August 12th, 2004. CCEE is a not-for-profit, private, civil organization company in which Agents are gathered in three Categories: Generation, Distribution, and Commercialization.*
>
> *The purpose of CCEE is to carry out the wholesale transactions and commercialization of electric power within the National Interconnected System... These activities form the Energy Accounting and Financial Settlement Process, which is entirely audited by outside auditors, pursuant ANEEL's Normative Resolution nº 109, dated October 26th, 2004 (Electric Power Commercialization Convention).*

One of the auctions carried out on 26th July 2007, open to all sources of energy (including hydro, wind and biomass) resulted in the commercialization of 1304 MW-average (electricity) and 1701.8 MW installed capacity (power) from 12 projects. Table below shows individual results of the 26 July 2007

auction. The prices indicated in the table is the actual price (tariff) paid in long-term contracts (at least 15 years) for projects dispatching electricity into the grid from 2010 onwards.

Table 5 – Electricity commercialized in the 26 July 2007 auction[11].

Project	source	Energy (MW-average)	Price (BRL/MWh)
Campina Grande	residual fuel oil	119	132.83
Global I	residual fuel oil	105	135.90
Global II	residual fuel oil	109	135.90
Nova Olinda	residual fuel oil	120	136.00
Tocantinópolis	residual fuel oil	120	135.90
Itapebi	residual fuel oil	103	133.60
Monte Pascoal	residual fuel oil	104	132.80
Termocabo	residual fuel oil	38	134.80
Termonordeste	residual fuel oil	123	135.97
Termoparaiba	residual fuel oil	123	135.92
Maracanau I	residual fuel oil	119	133.13
Viana	residual fuel oil	121	133.21
		weighted average price =	**134.67**

The prices results from the auctions (presented in Table 5, Table 6 and Table 7) are the actual tariff paid to the power producers, i.e., the value to be used as input in the investment analysis.

The other auction carried out in 2007 (on 18 June), open only to alternative energy sources (small-hydro, wind and biomass), resulted in the commercialization of 185 MW-average (electricity) and 638.64 MW installed capacity (power). Table 6 shows individual results of the 26 July 2007 auction.

[11] Official documents are publicly available at http://www.epe.gov.br/leiloes/Paginas/default.aspx?CategoriaID=42. Summary of the auction results in Portuguese downloaded from the above mentioned web-page is supplied in attached file named “Evidence 2-New energy auction press release.pdf”.

Table 6 – Electricity commercialized in the 18 June 2007 auction[12].

Project	Source	Energy (MW-average)	Price (BRL/MWh)
Ester	biomass	7	138.90
Flórida Paulista	biomass	8	139.12
Icanga	biomass	4	138.94
Louis Dreyfus Lagoa da Prata 1	biomass	13	139.12
Louis Dreyfus Lagoa da Prata 2	biomass	6	139.12
Louis Dreyfus Rio Brilhante 1	biomass	10	139.12
Louis Dreyfus Rio Brilhante 2	biomass	12	139.12
Pioneiros II	biomass	12	139.12
Santa Cruz AB 1	biomass	6	138.75
Santa Cruz AB 2	biomass	14	138.75
São João da Boa Vista	biomass	23	138.60
Xanxerê	biomass	25	138.50
Arvoredo	hydro	7	135.00
Ibirama	hydro	13	134.98
Pampeana	hydro	5	135.00
Pedra Furada	hydro	3	134.97
Santa Luzia Alto	hydro	14	135.00
Varginha	hydro	4	135.00
		weighted average price =	137.90

The highest price paid to the 30 selected projects in the two auctions shortly before the project start date was BRL 139.12/MWh, and the highest price paid to a small hydropower plant was BRL 135.00/MWh from 18 projects.

The results of the two public auctions unequivocally show that a project offering electricity to be dispatched into the Brazilian Interconnected System BRL 145/MWh (which would cross the project activity WACC benchmark of 17.4%) from January 2009 onwards (forecasted project operation start) would not be selected in the public auctions.

If the analysis is widened to include all energy contracted in auctions to be dispatched between 2008 and 2012 (see Table 7) the conclusion is the same, namely, it is very unlikely to obtain a tariff above BRL 145/MWh while the official public governmental auctions clearly indicate averages from BRL 122.12/MWh to BRL 134.64/MWh (see Table 7) and BRL 140/MWh as a market upper limit (see Table 6). It shall be noted that the year indicated the price paid to projects with operation start at that particular year and 15-year contracts (at least) are offered to the selected projects. Another conclusion that may be taken from the Table 7 is that for hydropower projects with operation start from 2008 to 2012 no unequivocal trend of increasing or decreasing prices can be seen (BRL 106.95/MWh in 2008, BRL 124.48/MWh in 2009 the year of the operation start of the project activity; BRL 115.48/MWh in 2010, BRL 121.86/MWh in 2011, BRL

[12] Official documents are publicly available at http://www.epe.gov.br/leiloes/Paginas/default.aspx?CategoriaID=43. Summary of the auction results in Portuguese downloaded from the above mentioned web-page is supplied in attached file named “Evidence 3-Alternative sources auction press release.pdf”.

129.14/MWh in 2012) and that all average prices in the whole period are below BRL 133.63/MWh used in the investment analysis and significantly smaller than the break even value of BRL 145/MWh.

Table 7 – Electricity contracted in public auctions to be dispatched between 2008 and 2012[13].

		Hydro	Biomass	Natural Gas	Coal	Residual fuel oil	Total
2008	MW-average	71	31	352	0	178	632
	MWh	622,358	271,734	3,085,491	0	1,560,277	5,539,859
	BRL/MWh	106.95	111.04	131.00	0.00	138.44	129.42
2009	MW-average	1074	110	479	0	642	2,305
	MWh	9,414,254	964,216	4,198,722	0	5,627,515	20,204,708
	BRL/MWh	124.38	133.80	127.25	0.00	134.77	128.32
2010	MW-average	935	140	570	292	1304	3,241
	MWh	8,195,836	1,227,184	4,996,392	2,559,555	11,430,342	28,409,310
	BRL/MWh	115.48	138.85	120.35	124.67	134.67	125.90
2011	MW-average	569	61	400	0	74	1,104
	MWh	4,987,626	534,702	3,506,240	0	648,654	9,677,222
	BRL/MWh	121.86	137.10	137.44	0.00	137.72	129.41
2012	MW-average	715	0	351	930	316	2,312
	MWh	6,267,404	0	3,076,726	8,152,008	2,769,930	20,266,067
	BRL/MWh	129.14	0.00	129.34	126.97	131.40	128.61
Total	MW-average	**3,364**	**342**	**2,152**	**1,222**	**2,514**	**9,594**
	MWh	**29,487,478**	**2,997,835**	**18,863,571**	**10,711,563**	**22,036,718**	**84,097,166**
	Share	**35.1%**	**3.6%**	**22.4%**	**12.7%**	**26.2%**	**100.0%**
	BRL/MWh	**122.12**	**134.39**	**128.27**	**126.42**	**134.64**	**127.77**

The price in which the project's IRR would be equal to the company's WACC was estimated as being equal to BRL 145.00/MWh. However, it should be noted that this scenario is quite unlikely – 8.52% higher than the forecasted PPA price, 7.41% higher than the ones obtained in the renewable sources auction and, around 13% higher than the most recent price paid to natural gas and oil fired power plants. With the presented evidences and taking into account the availability of energy with lower prices, as it is the case of thermoelectric ones it is not reasonable to believe in a scenario with prices over R$145/MWh (without the CDM incentives), necessary to make the project feasible.

To confirm that the breakeven value of BRL cannot be obtained three receipts of spot-market energy sales in the beginning of 2009 were supplied to the DOE. The evidences show the sale of 2,232 MWh at BRL 140.00/MWh, 3,335 MWh at BRL 83.64/MWh and, 7,085 MWh at BRL 75.00/MWh, determining a weighted average price of BRL 88.64/MWh, i.e., 39% below the breakeven value.

All official documents related to the auctions (source of all the information above disclosed) are publicly available at the government's Energy Research Company website (http://www.epe.gov.br/Lists/Leilao/AllItems.aspx).

[13] Source: ESPARTA, A.R.J. (2008). *Redução de emissões de gases de efeito estufa no setor brasileiro: a experiência do Mecanismo de Desenvolvimento Limpo do Protocolo de Quioto e uma visão futura.* PhD Thesis, Programa Interunidades de Pós graduação em energia - EP/FEA/IEE/IF da Universidade de São Paulo (available at http://www.teses.usp.br/teses/disponiveis/86/86131/tde-29042008-160752/, site accessed on 3 April 2009).

As mentioned before, also a decrease in project's costs has to be considered when the sensitivity analysis is conducted. When this is done the total investment as well as the operation and maintenance costs are to be reduced, when these values constitute more than 20% of total project's costs.

According to the guidance, "*variations in the sensitivity analysis should at least cover a range of +10% and -10%, unless this is not deemed appropriate in the context of the specific project circumstances*". The result when the 10% variation of the operating and maintenance costs is applied is that the project's IRR is 16.05%, which is below the WACC.

Concerning the decrease in investment it is the understanding of the PPs that the best source to support any statement about changes in the estimated investment is their own experience.

The PPs already implemented two CDM small hydropower plants, Santa Edwiges I (CDM 0830[14]) and Santa Edwiges II (CDM 0831[15]). The estimated investment for both projects (BRL 43,319,842 for Santa Edwige I and BRL 42,967,541 for Santa Edwiges II) are released in the registered PDD appendices containing the cash flow information. The actual investment in both projects comes from the audited balances supplied to the DOE.

Likewise the estimated cost for Santa Edwiges III (CDM 2165[16], the present project activity) is released in the validated cash flow (BRL 57,883,392). The actual investment can only be estimated as all the expenses of the project are not disbursed yet. The audited version of the 2008 balance shows already disbursed BRL 54,791,000 at the end of 2008[17]. Furthermore many equipments and service suppliers foresee closing payments after the projects commissioning in January 2009. Examples are given of the generators and automation summing BRL 1,094,000. Summarizing, with the presented evidences the amount of BRL 55,885,000 (96.5% of the initially estimated costs) is already disbursed confirming that a 7% reduction is already not achievable even without the estimated additional BRL 3,500,000 to be accounted in the first semester of 2009 (post commissioning costs, for example, wages and layoff expenses of the civil workers; analogous to December 2008). All the evidences of these figures were presented to the DOE. The below table summarizes the PPs experience while implementing the small hydropower plants.

[14] http://cdm.unfccc.int/Projects/DB/BVQI1167141448.3/view.

[15] http://cdm.unfccc.int/Projects/DB/BVQI1167161981.54/view.

[16] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218634643.54/view.

[17] The balance provided to the DOE during the review process of the project as evidence of the total investments made in 2008 was audited and approved by the project activity's finance director and chartered accountant. This document showed that BRL 51,934,309.74 was disbursed by the end of 2008 as well as already committed costs (cash and advance payments) in the order of BRL 3,317,718. Hence, the total expenses made in 2008 totalized BRL 55,302,027.88. Also it was presented to the DOE an expert opinion from an external source confirming that the balance, tough it wasn't audited by an independent third party, was an official and legal document in conformity with the applicable Brazilian legislation. When these values and the payments to be made in 2009 are summed together we have that the total estimated expenses estimated during the review process were BRL 56,396,027 (97.4% of the initially estimated costs). However, after the project activity was registered under corrections (EB) the DOE requested to project participants to provide an audited balance to confirm these figures. Therefore, information regarding 2008 expenses was up-dated using the figures of the audited balance which still confirms, despite the slight difference, all the assumptions made during the review process.

Table 8 – Project Participants' experience with small hydropower plants experience.

	Estimated investment	Actual investment	diff
Sta Edwiges I	BRL 43.319.842	BRL 43.551.959	0,54%
Sta Edwiges II	BRL 42.967.541	BRL 40.463.354	-5,83%
Sta Edwiges III	BRL 57.883.392	BRL 59.385.000	2,59%

The numbers show that although a reduction in investment expenses is according to the PPs experience possible, achieving 7% reduction is rather unlikely.

Also data from another project developer was used and the corresponding evidences were also supplied to the DOE. The information provided shows a forecasted investment of BRL 213,048,000 for two SHPs with operation start in 2008 (total of 54 MW installed capacity) and actual investment of BRL 226,008,189 (6% above the estimated), confirming the more likely trend of actual costs above the initially estimated investment.

The conclusions corroborate per review literature findings related to the estimation of construction costs and schedules in developing countries. Using a sample of 125 projects (59 thermal and 66 hydropower) Bacon and Besant-Jones (1998)[18] show that although the ratio of actual to estimated cost can be smaller than one (indicating actual investment smaller than estimated), less than 10% of the analyzed projects disbursed less than forecasted. One of the conclusions of the paper is that "*the estimated values were significantly biased below actual values*".

In order to further confirm the conclusion the PPs contacted the Brazilian Association for the Small and Medium Electrical Energy Producers (APMPE, from the Portuguese "*Associação Brasileira dos Pequenos e Médios Produtores de Energia Elétrica*") asking for an expert opinion.

The answer from APMPE's president, Mr. Ricardo Pigatto, corroborates that the likelihood of higher actual than estimated costs is elevated. To confirm the statement Mr. Piggato reminds that the "*Guidance for Small Hydropower Plants Studies and Projects*"[19] prepared by the state owned Federal Power Utility Eletrobrás (Centrais Eletricas Brasileiras S.A.) recommends in its Annex 3 to add 5% on the top of estimated for unforeseen expenses. The PPs confirm that the presented estimated costs for the project activity do not include any cost for unforeseen expenses.

From the above information and the attached evidences the PPs are confident to state that a reduction in the project activity investment expenses is unlikely and a reduction of 7% in investments costs is very unlikely.

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[18] R. W. Bacon and J. E. Besant Jones (1998). *Estimating construction costs and schedules – Experience with power generation projects in developing countries.* Energy Policy, vol. 26, no 4, pp 317-333.

[19] Available at <http://www.eletrobras.gov.br/EM_Atuacao_Manuais/default.asp>, site accessed on 3 April 2009.

Outcome: The IRR of the project activity without being registered as a CDM project is below the WACC benchmark, evidencing that project activity is not financially attractive to investor. The knowledge of the CDM registering benefits was the key points to decision-making to implement the project activity.

Step 3. Barrier analysis

3.a. Identify barriers that would prevent the implementation of type of the proposed CDM project activity

The considered barriers are the following:

- Investment barriers;
- lack of infrastructure, and
- institutional barrier.

To support the barrier analysis a brief overview of the Brazilian electricity market in the last years is first presented.

Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 on due to the increase in international interest rates and the lack of investment capacity of the State, the government was forced to look for alternatives. The solution recommended was to initiate a privatization process and the deregulation of the market.

The four pillars of the privatization process initiated in 1995 were:

- Building a competition friendly environment, with the gradual elimination of the captive consumer. The option to choose an electricity services supplier which began in 1998 for the largest consumers, and should be available to the entire market by 2006;
- Dismantling of the state monopolies, separating and privatizing the activities of generation, transmission and distribution;
- Allowing free access to the transmission lines, and
- Placing the operation and planning responsibilities to the private sector.

At the same time three entities were created, the Electricity Regulatory Agency, ANEEL set up to develop the legislation and to regulate the market; the National Electric System Operator, ONS, to supervise and control the generation, transmission and operation; and the Wholesale Electricity Market, MAE, to define rules and commercial procedures of the short-term market.

At the end of 2000, after five years of the privatization process, results were modest (Figure 5). Despite high expectations, investments in new generation did not follow the increase in consumption.

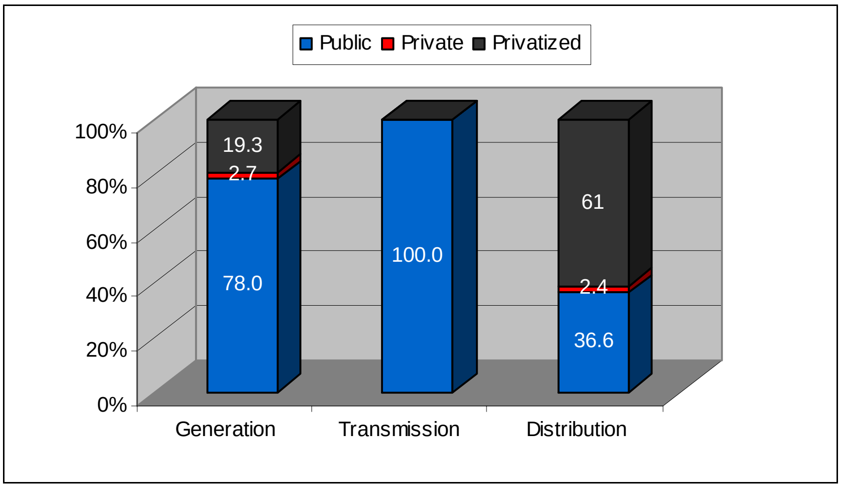


Figure 5 - Participation of private capital in the Brazilian electricity market in December 2000 (BNDES, 2000)

The decoupling of GDP (average of 2% increase in the period of 1980 to 2000) from electricity consumption increase (average of 5% increase in the same period) is well known in developing countries, mainly due to the broadening of supply services to new areas and the growing infra-structure. The necessary measures to prevent bottlenecks in services were taken. These include an increase of generation capacity higher than the GDP growth rate and strong investments in energy efficiency. In the Brazilian case, the increase in the installed generation capacity (average of 4% in the same period) did not follow the growth of consumption as can be seen in Figure 6.

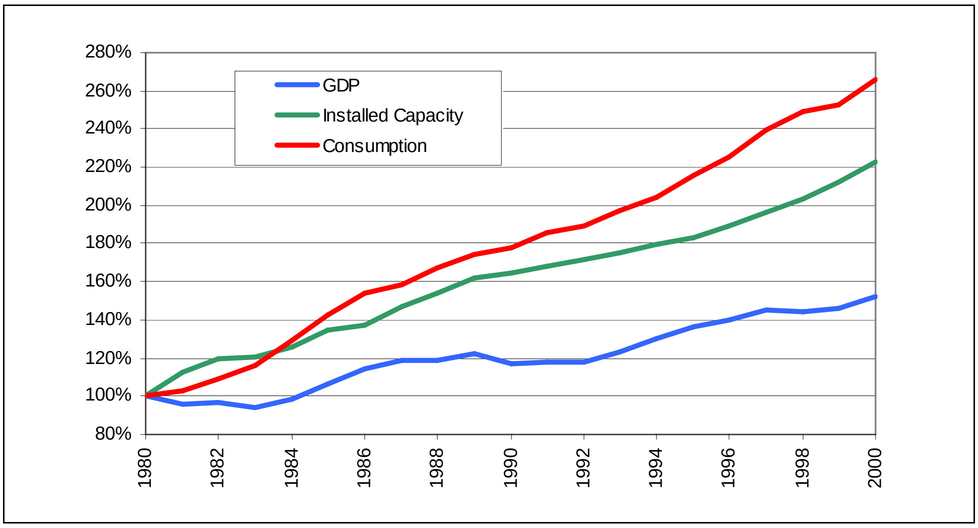


Figure 6 - Cumulated variation of GDP, electricity supply (installed capacity) and demand (consumption) (Source: Eletrobrás, http://www.eletrobras.gov.br; IBGE, http://www.ibge.gov.br/)

Without new installed capacity, the only alternatives were energy efficiency improvements or higher capacity utilization (capacity factor). Regarding energy efficiency, the government established in 1985 PROCEL (the National Electricity Conservation Program).

The remaining alternative, to increase the capacity factor of the old plants was the most widely used, as can be seen in Figure 7. To understand if such increase in capacity factor brought positive or negative consequences one needs to analyze the availability and price of fuel. In the Brazilian electricity model the primary energy source is water accumulated in the reservoirs. Figure 8 shows what has happened to the levels of "stored energy" in the reservoirs from January 1997 to January 2002. It can be seen that reservoirs which were planned to withstand 5 years of less-than-average rainy seasons, almost collapsed after a single season of low rainfall (2000/2001 experienced 74% of historical average rainfall. This situation depicts a very intensive use of the country's hydro resources to support the increase in demand without increase of installed capacity. Under the situation described there was no long-term solution for the problems that finally caused shortage and rationing in 2001.

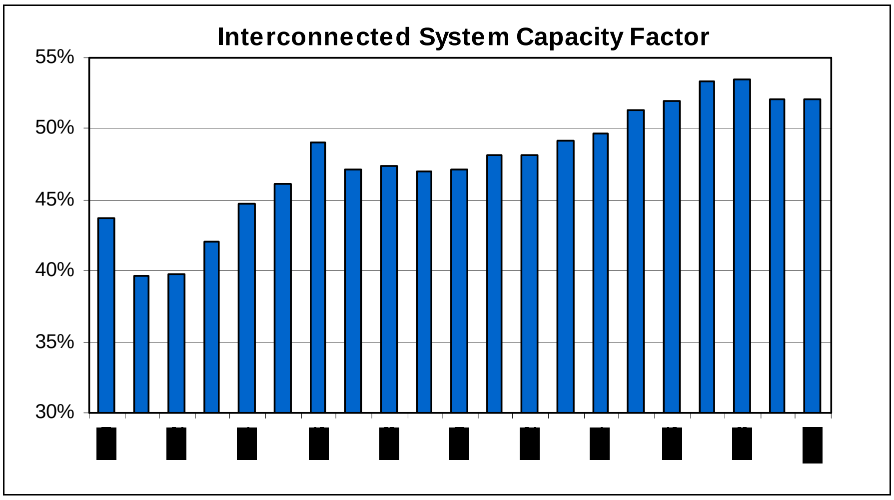


Figure 7 - Evolution of the rate of generated energy to installed capacity (Source: Eletrobrás, http://www.eletrobras.gov.br/).

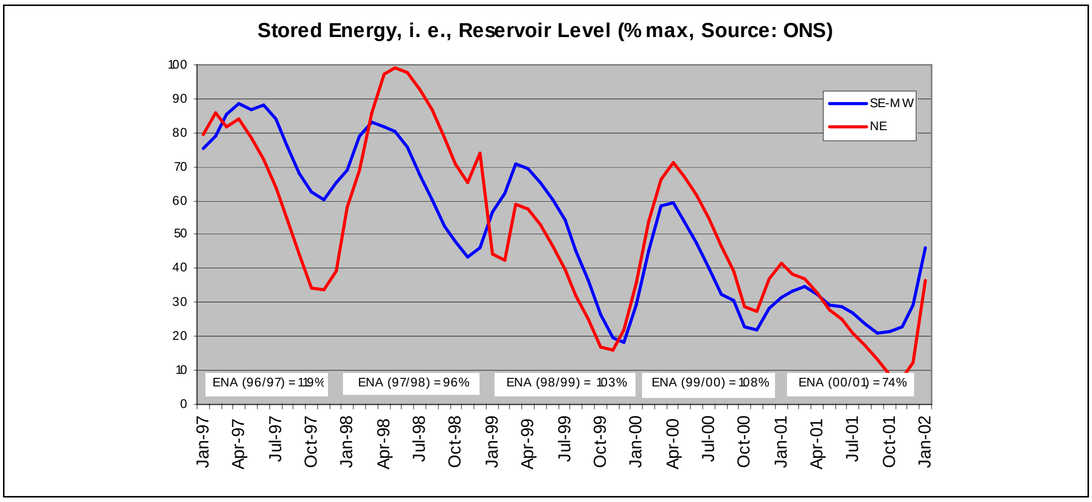


Figure 8 - Evolution of the water stored capacity for the Southeast/Midwest (SE-MW) and Northeast (NE) interconnected subsystems and intensity of precipitation in the rainy season (ENA) in the southeast region compared to the historic average (Source: ONS, http://www.ons.org.br/)

Aware of the difficulties since the end of the 1990's, the Brazilian government signalized that it was strategically important for the country to increase thermoelectric generation and consequently be less dependent of hydropower. With that in mind the federal government launched in the beginning of the year of 2000 the Thermoelectric Priority Plan (PPT, *Plano Prioritário de Termelétricas*, Federal Decree 3,371 of February 24th, 2000, and Ministry of Mines and Energy Directive 43 of February 25th, 2000), originally planning the construction of 47 thermo plants using Bolivian natural gas, totalizing 17,500 MW of new installed capacity by December of 2003. During 2001 and the beginning of 2002 the plan was reduced to 40 plants and 13,637 MW to be installed by December 2004 (Federal Law 10,438 of April 26th, 2002, Article 29). As of December 2004, 20 plants totalizing around 9,700 MW are operational.

During the rationing of 2001 the government also launched the Emergency Energy Program with the short-term goal of building 58 small to medium thermal power plants until by end of 2002 (using mainly diesel oil, 76,9%, and residual fuel oil, 21.1%), totalizing 2,150 MW power capacity (CGE-CBEE, 2002).

It is clear that hydroelectricity is and will continue as the main source for the electricity base load in Brazil. However, most if not all-hydro resources in the South and Southeast of the country have been exploited, and most of the remaining reserves are located in the Amazon basin, far from the industrial and population centers (OECD, 2001). Clearly, new additions to Brazil's electricity power sector are shifting from hydro to natural gas plants (Schaeffer *et al.*, 2000). With discoveries of vast reserves of natural gas in the Santos Basin in 2003 the policy of using natural gas to generate electricity remains a possibility and it will continue to generate interest from private-sector investors in the Brazilian energy sector.

In power since January 2003, the newly elected government decided to fully review the electricity market institutional framework. A new model for the electricity sector was approved by Congress in March 2004. The new regulatory framework for the electricity sector has the following key features (OECD, 2005):

- Electricity demand and supply will be coordinated through a "Pool" Demand to be estimated by the distribution companies, which will have to contract 100 per cent of their projected electricity demand over the following 3 to 5 years. These projections will be submitted to a new institution called Energy Planning Company (*Empresa de Pesquisa Energética*, EPE), which will estimate the required expansion in supply capacity to be sold to the distribution companies through the Pool. The price at which electricity will be traded through the Pool is an average of all long-term contracted prices and will be the same for all distribution companies.
- In parallel to the "regulated" long-term Pool contracts, there will be a "free" market. Although in the future, large consumers (above 10 MW) will be required to give distribution companies a 3-year notice if they wish to switch from the Pool to the free market and a 5-year notice for those moving in the opposite direction a transition period is envisaged during which these conditions will be made more flexible. If actual demand turns out to be higher than projected, distribution companies will have to buy electricity in the free market. In the opposite case, they will sell the excess supply in the free market. Distribution companies will be able to pass on to end consumers the difference between the costs of electricity purchased in the free market and through the Pool if the discrepancy between projected and actual demand is below 5%. If it is above this threshold, the distribution company will bear the excess costs.
- The government opted for a more centralized institutional set-up, reinforcing the role of the Ministry of Mines and Energy in long-term planning. EPE will submit to the Ministry its desired technological portfolio and a list of strategic and non-strategic projects. In turn, the Ministry will submit this list of projects to the National Energy Policy Council (*Conselho Nacional de Política*

Energética, CNPE). Once approved by CNPE, the strategic projects will be auctioned on a priority basis through the Pool. Companies can replace the non-strategic projects proposed by EPE, if their proposal offers the same capacity for a lower tariff. Another new institution is a committee (*Comitê de Monitoramento do Setor Elétrico*, CMSE), which will monitor trends in power supply and demand. If any problem is identified, CMSE will propose corrective measures to avoid energy shortages, such as special price conditions for new projects and reserve of generation capacity. The Ministry of Mines and Energy will host and chair this committee. No major further privatizations are expected in the sector.

Although the new model reduces market risk, its ability to encourage private investment in the electricity sector will depend on how the new regulatory framework is implemented. Several challenges are noteworthy in this regard. *First,* the risk of regulatory failure that might arise due to the fact that the government will have a considerable role to play in long-term planning should be avoided by preventing from political interference. *Second,* rules will need to be designed for the transition from the current to the new model to allow current investments to be rewarded adequately. *Third,* because of its small size, price volatility may increase in the short-term electricity market, in turn bringing about higher investment risk, albeit this risk will be attenuated by the role of large consumers. The high share of hydropower in Brazil's energy mix and uncertainty over rainfall also contribute to higher volatility of the short-term electricity market. *Fourth,* although the new model will require total separation between generation and distribution, regulations for the unbundling of vertically integrated companies still have to be defined. Distribution companies are currently allowed to buy up to 30 per cent of their electricity from their own subsidiaries (self-dealing). *Finally,* the government's policy for the natural gas sector needs to be defined within a specific sectoral framework.

Investment Barrier

Completion and Credit Risk

Financing from BNDES is only available to companies willing to offer corporate or real guarantees in excess of total amount borrowed. In other words, Rialma Companhia Energética III S.A. will have to use its own balance sheet and capital to raise funds from BNDES. In case project underperform or become unfeasible, BNDES will call Rialma's guarantees and real assets up to their initial credit exposure. In addition to leveraging their balance sheet with sizeable borrowings, Rialma faces completion risk of the project and credit risk of the utility. Completion risk is mitigated by guarantees pledged by the construction company; which are however, of limited recourse. The credit risk of the utility though is difficult to hedge. Once the Power Purchase Agreement is signed, Rialma is immediately exposed to the utility's long term credit risk.

The pro-forma income statement analysis of the project shows that project's profitability could increase when revenues from CERs are considered and thus render projects marginally attractive. In sum, in the absence of CDM, Santa Edwiges III would be a riskier, less attractive and ultimately unfeasible project.

Lack of Infrastructure

The region where the project is located is isolated and undeveloped. There is a lack of infrastructure, such as roads, reliable electricity supply, communication and transports. In addition, there were no qualified personnel available in the regions due to the lack of schools and universities.

Institutional Barrier

As described above, since 1995 government electricity market policies have been continuously changing in Brazil. Too many laws and regulations were created to try to organize and to provide incentives for new investments in the energy sector. The results of such regulatory instability were the contrary to what was trying to be achieved. During the rationing period electricity prices surpassed BRL 600/MWh (around USD 200/MWh) and the forecasted marginal price of the new energy reached levels of BRL 120 – 150/MWh (around USD 45). In the middle of 2004 the average price was bellow BRL 50/MWh (less than USD 20/MWh). This low price of energy was also observed during the year of 2005. In 2006 the energy price was, as of September, the BRL 123/MWh and again in 2007, the prices decreased significantly, reaching less than BRL 40/MWh[20]. This relatively high volatility of the electricity price in Brazil, although in the short term, contributes to the difficult the analysis of the market by the developers.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

As described above, the main alternative to the project activity is to continue the status quo. The project sponsor could invest their resources in different financial market investments. Therefore, the barriers above do not affect the investments in other opportunities. On the contrary: Brazilian interest rates, which represent a barrier for the project activity, are very attractive and a viable investment alternative.

Step 4. Common practice analysis:

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.

As the alternative to the project activity is the continuation of the current (previous) situation of electricity supplied by large hydro and thermal power stations, the common practice analysis will be held for two sides: the common practice of the power supply in the grid, as well as analyze similar Small Hydro plants being constructed in the region.

The analysis considered the plants that fit to the official definition of Small Hydro Power Plant which states that SHPPs are those with an installed capacity between 1000kW and 30,000 kW, with a total reservoir area with less than 3,0 km² (ANEEL Resolution nr. 652, from December 10th,2003).

Concerning the analysis of the similar projects in the region, it will be considered the plants located in the same state and in the same sub-system that became operational in the past three years. This figure represents projects that took place *in a comparable environment with respect to regulatory framework,*

[20] Source: http://www.ccee.org.br/

investment climate, access to technology, access to financing, etc., as stated in the "Tool for demonstration and assessment of additionality".

Sub-step 4a. Analyze other activities similar to the proposed project activity

For the electricity supply to the grid

One of the points to be considered when analyzing a small hydro project investment is the possibility to participate in the Proinfa Federal Government Program. Although some projects started construction independently from Proinfa, the program is considered one of the more viable financing alternatives for these projects, which will provide long-term PPAs and special financing conditions. Santa Edwiges III is not participating in the program and is addressing the market as it structures its projects.

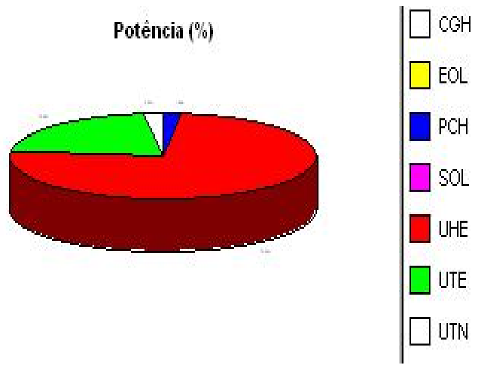
Both process of negotiating a PPA with utility companies and obtaining funding from BNDES have proved to be very cumbersome. BNDES also requires excessive guarantees in order to provide financing. Other risks and barriers are related to the operational and technical issues associated with small hydros, including their capability to comply with the PPA contract and the potential non-performance penalties.

Regardless of the risks and barriers mentioned above, the main reason for the reduced number of similar project activities is the economic cost. Project feasibility requires a PPA contract with a utility company, but the utilities do not have the incentives or motivation to buy electricity generated by small hydro projects.

Most of the developers that funded their projects outside of Proinfa have taken CDM as decisive factor for completing their projects. Therefore, to the best of our knowledge the vast majority of similar projects being developed in the country are participating in the Proinfa Program and not in the CDM. Nevertheless, there is no official restraint for projects derived from public policies to participate in the CDM.

Only 1.70% of Brazil's installed capacity comes from small hydro power sources (1.6 GW out of 98.1 GW). Also, from the 3.6 GW under construction in the country, only 948 MW are small hydro. Many other projects are still under development, waiting for better investment opportunities. Common practice in Brazil has been the construction of large-scale hydroelectric plants and, more recently, of thermal fossil fuel plants, with natural gas, which also receive incentives from the government. Already 21.3% of the power generated in the country comes from thermal power plants, and this number tends to increase in the next years, since 42% of the projects approved between 1998 and 2005 are thermal power plants (compared to only 14% of SHPPs)[21].

[21] ANEEL – *Agência Nacional de Energia Elétrica* (Brazilian power regulatory agency)



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 9 - Operational types of project (Source: ANEEL, 2007)

Moreover, in the most recent energy auction, which took place on December 16th, 2005, in Rio de Janeiro, 20 concessions for new power plants were granted, of which only two are for SHPPs (28 MW). From the total of 3,286 MW sold, 2,247 MW (68%) will come from thermal power plants, from which 1,391 come from natural gas fired thermal power plants, i.e., 42% of the total sold[22].

For similar SHPs

The political and economic characteristic of Brazil has changed a lot in the past few years. The country has long suffered with inflation, for instance, which had only become stable recently. Moreover, it has to mentioned also that the sector regulation it still under implementation and this affects projects that were developed or are still being developed in the country. Considering this, project participants (PPs) held a research about the small hydro power plants (SHPPs) that started operation since 2005 which represents as referred in the **Tool for demonstration and assessment of additionality** "*environment with respect to regulatory framework, investment climate, access to technology, access to financing*". It was also identified the number of SHPPs that received any kind of financial incentive (Proinfa or CDM).

Table 9 - Operations start of SHPPs from 2005 to 2007.

[22] Rosa, Luis Pinguelli. Brazilian. Newspaper "Folha de São Paulo", December 28, 2005.

Started operations in 2005

	Name	State	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CDM	Proinfa
1	Camargo Corrêa	MT												2,00		
2	Comendador Venâncio	RJ			0,77											
3	Cristalino	PR								4,00					X	
4	Faxinal II	MT											10,00			
5	Furnas do Segredo	RS										9,80			X	
6	Ivan Botelho III	MG	12,20	12,20											X	
7	Ombreiras	MT							26,00						X	
8	Porto Góes	SP											14,30			
9	Salto Corgão	MT						13,50	13,50						X	
10	Santa Clara I	PR								3,60					X	
11	Santo Antônio	RS										4,50				
	PARTIAL TOTAL		12,20	12,20	0,77	-	-	13,50	39,50	7,60	-	14,30	24,30	2,00	6	0

TOTAL = 126,37 MW

Started operations in 2006

	Name	State	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CDM	Proinfa
1	Aquarius	MS/MT									4,20				X	X
2	Camargo Corrêa	MT	2,00													
3	Canoa Quebrada	MT												28,00		X
4	Carlos Gonzatto	RS				9,00										X
5	Comendador Venâncio	RJ					0,84									
6	Esmeralda	RS												22,20		X
7	Fundão I	PR												2,48	X	
8	Garganta da Jararaca	MT											14,65	14,65	X	
9	Mosquitão	GO												30,00		X
10	Piranhas	GO												18,00		X
11	Rio Palmeiras I	SC							1,50							
12	Rio Palmeiras II	SC											1,38			
13	Sacre 2	MT									10,00	20,00			X	
14	Saldanha	RO			4,80										X	
15	Santa Edwiges I	GO											10,10		X	
16	Santa Edwiges II	GO	13,00												X	
17	São Bernardo	RS								15,00						X
18	Senador Jonas Pinheiro	MT									6,30					X
	PARTIAL TOTAL		15,00	-	4,80	9,00	0,84	-	1,50	15,00	20,50	20,00	26,13	115,33	7	8

TOTAL = 228,1 MW

Started operations in 2007

	Name	State	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	CDM	Proinfa
1	Braço Norte IV	MT											14,00		X	
2	Buriti	MS		30,00											X	X
3	Caju	SC						3,20								
4	Contestado	SC											5,55			
5	Coronel Araújo	SC											5,55			
6	Faxinal dos Guedes	SC		4,00											X	
7	Flor do Sertão	SC							16,50							X
8	José Gelásio da Rocha	MT		23,70												X
9	Ludesa	SC								30,00						X
10	Mafrás	SC											2,16			
11	Primavera	RO		13,65	4,55										X	
12	Rondonópolis	MT												26,60		X
13	Santa Laura	SC										15,00				X
14	São João (Castelo)	ES				25,00									X	
	PARTIAL TOTAL		-	71,35	4,55	25,00	-	3,20	16,50	30,00	-	15,00	27,26	26,60	5	6
			TOTAL = 219,46 MW													

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

In number of SHPPs, there were 43 that started operations from 2005 to 2007, where 18 received CDM incentives and 14 from Proinfa, totalizing 32 projects with some kind of incentives, which represents 74.4 % of the total SHPPs. In terms of installed capacity it is 90.6 % of the total 520.18 MW.

For the specific year of 2007, when Santa Ewiges III started being constructed, among the 14 SHPPs that started operations, 10 received incentives. In terms of installed capacity represents 92.4 % of the total 219.4 MW.

Considering the state of Goiás, among the 4 SHPPs that started operations named Mosquitão, Piranhas, Santa Edwiges I and Santa Edwiges II in the period from 2005 to 2007, all of them received incentives representing 100% of the installed capacity. The first two SHPPss (Mosquitão and Piranhas) were planned to receive Proinfa's subsides. The last two SHPPs (Santa Edwiges I and Santa Edwiges II) corresponds to CDM projects.

Regarding the South-Southeast-Midwest sub-system where the plant is located, it can be seen in the above table that only one SSPH became operational in the North region. Hence, the information mentioned above is representative for the sub-system which the plant is connected to.

From this result, it is clearly demonstrated that common practice for SHPPs is the implementation of the activity through the CDM 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:

The barriers mentioned in Step 3 could be seen as common practice, representing the majority situation of small hydros in Brazil. They required some source of financial incentives to be constructed in the last years. Also, it is demonstrated that the construction of small hydros WITHOUT financial incentives are specific cases and that a NEED to financial incentives is the common practice.

Regarding the grid, it was demonstrated that SHPPs construction is not a common practice in the country. Relating to the construction of similar activities in the state, it can be seen that financial incentives is the common practice once 100% of the installed capacity of the region was achieved through some sort of incentive.

In summary, this project cannot be considered common practice and therefore is not a business as usual type scenario. And it is clear that, in the absence of the incentive created by the CDM, this project would not be the most attractive scenario.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to the “Thresholds and criteria for the eligibility for the hydroelectric power plants with reservoirs as CDM project activity”[23], emissions from reservoirs, if there is any, shall be estimated considering the power density (W/m^2) of the plant. Project Emissions are estimated considering the following criteria:

a) if the power density of project is greater than $4W/m^2$ and less than or equal to $10W/m^2$:

$$PEy = \frac{EF_{Res} * EGy}{1000}$$

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 per EB23 is 90 $KgCO_2e$/MWh

Egy: Electricity produced by the hydro electric power project in year *y*, in MWh

b) If power density of the project is greater than $10W/m^2$, $PEy = 0$.

Considering that Santa Edwiges III has installed capacity of 11.6 MW and small reservoir 0.64 km^2 its power density is 18.13 W/m^2 and in this case project activity emissions are zero (option b).

There are no emissions from use of fossil fuels and the calculation of leakage is also not applicable once GHG emissions by the project activity are zero.

[23] EB 23 Report, Annex 5

The anthropogenic emissions by sources of GHGs in the baseline were calculated according to approved methodology AMS-1.D, a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002.

From ACM0002, a baseline emission factor (*EFy*) is calculated as a combined margin (*CM*), consisting of the combination of operating margin (*OM*) and build margin (*BM*) factors according to the following three steps:

- **STEP 1 -** Calculate the operating margin emission factor(s), based on one of the following methods:
    - Simple operating margin
    - Simple adjusted operating margin
    - Dispatch data analysis operating margin
    - Average operating margin.

Dispatch data analysis operating margin should be the first methodological choice. Since not enough data was supplied by the Brazilian national dispatch center, the choice is not currently available. The simple operating margin can only be used where low-cost/must-run resources[24] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normals for hydroelectricity production. Table 10 shows the share of hydroelectricity in the total electricity production for the Brazilian S-SE-CO interconnected system. However the results show the non-applicability of the simple operating margin to the Project.

Table 10 - Share of hydroelectricity production in the Brazilian S-SE-CO interconnected system from 2002 to 2006 (ONS, 2007)

Year	Share of hydroelectricity (%)
2002	88.9%
2003	90.7%
2004	86.9%
2005	88.2%
2006	86.1%

The fourth alternative, an average operating margin, is an oversimplification and, due to the high share of a low operating cost/must run resource (hydro), does not reflect at all the impact of the project activity in the operating margin. Therefore, the simple adjusted operating margin will be used here.

The simple adjusted operating margin emission factor ($EF_{OM,adjusted,y}$ in tCO_2/MWh) is a variation on the simple operating margin, where the power sources (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (*j*):

[24] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation (ACM0002, 2006).

$$EF_{OM,simple-adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}\cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \cdot \frac{\sum F_{i,k,y}\cdot COEF_{i,k}}{\sum_k GEN_{k,y}} \quad \textbf{Equation 4}$$

Where:

- λ_y is the share of hours in year *y* (in %) for which low-cost/must-run sources are on the margin.
- $\sum_{i,j} F_{i,j,y}$ is the amount of fuel *i* (in mass or volume unit) consumed by relevant power sources *j* (analogous for sources *k*) in year(s) *y*,
- $COEF_{i,j}$ is the CO_2e coefficient of fuel *i* (tCO_2e/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources *j* (analogous for sources *k*) and the percent oxidation of the fuel in year(s) *y* and,
- $\sum_j GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j* (analogous for sources *k*).

The most recent numbers for the interconnected S-SE-CO system were obtained from the Brazilian national dispatch center, ONS - *Operador Nacional do Sistema Elétrico,* in the form of daily consolidated reports (ONS-ADO, 2006). Data from 143 power plants, comprising 68.2 GW installed capacity and around 932 TWh electricity generation over the 3-year period were considered.

Low-cost/must-run resources in Brazilian S-SE-CO interconnected system are hydro and thermonuclear power plants, considered free of greenhouse gases emissions, i.e., $COEF_{i,j}$ for these plants is zero. Hence, the low-cost/must-run part of the Equation 4 is null, so this equation turns to the following:

$$EF_{OM,simple-adjusted,y} = (1-\lambda_y).EF_{OM-non,y} = (1-\lambda_y).\frac{\sum_{i,j} F_{i,j,y}\cdot COEF_{i,j}}{\sum_j GEN_{j,y}} \quad \textbf{Equation 5}$$

Where:

- $EF_{OM-non,y}$ is emission factor for **non**-low-cost/must-run resources(in tCO_2/MWh) by relevant power sources *k* in year(s) *y*.

Non-low-cost/must-run resources in Brazilian S-SE-CO interconnected system are thermo power plants burning coal, fuel oil, natural gas and diesel oil. These plants result in non-balanced emissions of greenhouse gases, calculated as follows:

The product $\sum_{i,j} F_{i,j,y}\cdot COEF_{i,j}$ for each one of the plants was obtained from the following formulae:

$$F_{i,j,y} = \frac{GEN_{i,j,y}\cdot 3{,}6\times 10^{-6}}{\eta_{i,j,y}\cdot NCV_i} \quad \textbf{Equation 6}$$

$$COEF_{i,j} = NCV_i \cdot EF_{CO2,i} \cdot 44/12 \cdot OXID_i$$ **Equation 7**

$$Hence,\ F_{i,j,y} \cdot COEF_{i,j} = \frac{GEN_{i,j,y} \cdot EF_{CO2,i} \cdot OXID_i \cdot 44/12 \cdot 3{,}6 \times 10^{-6}}{\eta_{i,j,y}}$$ **Equation 8**

Where variable and parameters used are:

- $\sum_{i,j} F_{i,j,y}$ is given in [kg], $COEF_{i,j}$ in [tCO_2e/kg] and $F_{i,j,y} \cdot COEF_{i,j}$ in [tCO_2e]
- $GEN_{i,j,y}$ is the electricity generation for plant *j*, with fuel *i*, in year *y*, obtained from the ONS database, in MWh
- $EF_{CO2,i}$ is the emission factor for fuel *i*, obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, in tC/TJ.
- $OXID_i$ is the oxidization factor for fuel *i*, obtained from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, in %.
- 44/12 is the carbon conversion factor, from tC to tCO_2.
- 3.6 x 10^{-6} is the energy conversion factor, from MWh to TJ.
- $\eta_{i,j,y}$ is the thermal efficiency of plant *j*, operating with fuel *i*, in year *y*, obtained from Bosi et al. (2002).
- NCV_i is the net calorific value of fuel *i* [TJ/kg].

$\sum_{j,y} GEN_{j,y}$ is obtained from the ONS database, as the summation of non-low-cost/must-run resources electricity generation, in MWh.

The λ_y factors are calculated as indicated in methodology ACM0002, with date obtained from the ONS database. Figure 10, Figure 11 and Figure 12 present the load duration curves and λ_y calculations for years 2004, 2005 and 2006, respectively. The results for years 2004, 2005 and 2006 are presented in Table 11.

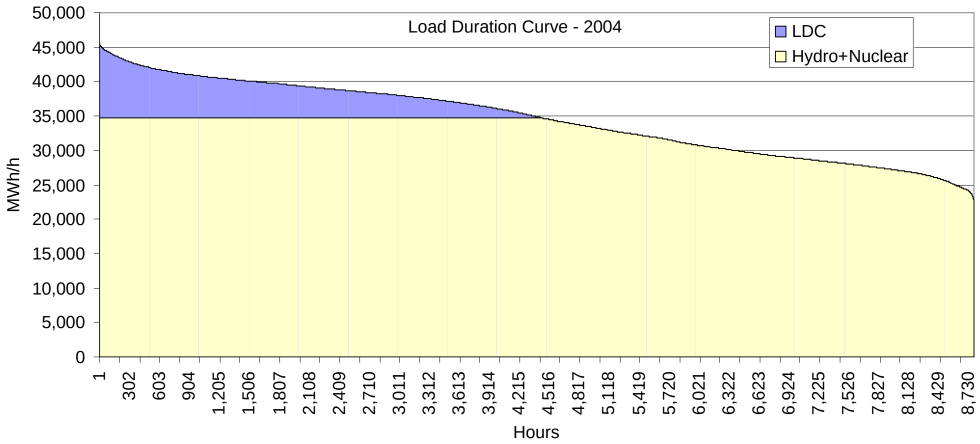


Figure 10 - Load duration curve for the S-SE-CO system, 2004

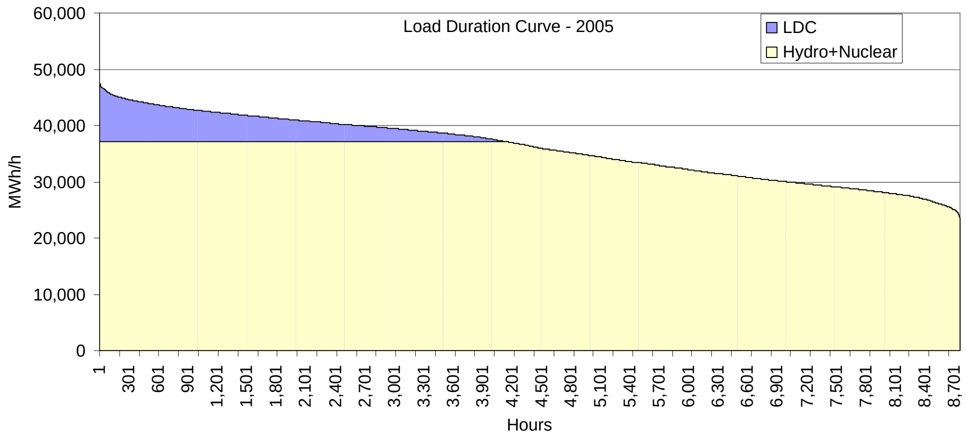


Figure 11 - Load duration curve for the S-SE-CO system, 2005

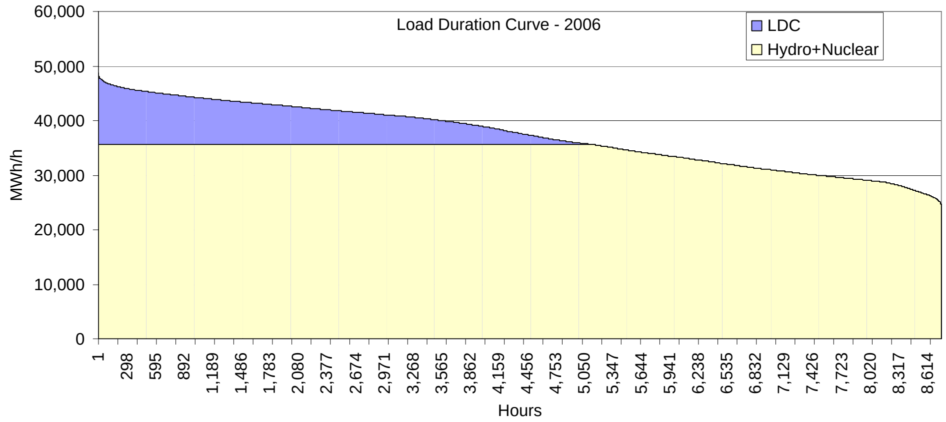


Figure 12 - Load duration curve for the S-SE-CO system, 2006

Table 11 - Share of hours in year *y* (in %) for which low-cost/must-run sources are on the margin in the S-SE-CO system for the period 2004-2006 (ONS-ADO, 2005).

Year	$\frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_{k} GEN_{k,y}}$ **[tCO_2/MWh]**	λ_y **[%]**
2004	0.9886	0.4937
2005	0.9653	0.5275
2006	0.8071	0.4185

With the numbers from ONS, the first step was to calculate the lambda factors and the emission factors for the simple operating margin. The obtained values can be seen in Table 11, Figure 10, Figure 11 and Figure 12.

Finally, applying the obtained numbers to calculate $EF_{OM,simple\text{-}adjusted,2004\text{-}2006}$ as the weighted average *of* $EF_{OM,simple\text{-}adjusted\ 2004}$, $EF_{OM\ simple\text{-}\ adjusted,2005}$ *and* $EF_{OM,simple\text{-}adjusted,2006}$ and λ_y to Equation 1:

- $EF_{OM,simple\text{-}adjusted,2004\text{-}2006} = 0.4749\ tCO_2e/MWh.$

- **STEP 2** – Calculate the build margin mission factor ($EF_{BM,y}$) as the generation weighted average emission factor (tCO_2e/MWh) of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$ **Equation 9**

Where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method (ACM0002, 2006) for plants *m*, based on the most recent information available on plants already built. The sample group m consists of either:

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Project participants should use from these two options that sample group that comprises the larger annual generation.

Applying the data from the Brazilian national dispatch center to Equation 2:

- $EF_{BM,2006} = 0.0903\ tCO_2e/MWh$.

As per ACM0002 methodology project participants had chosen option 1, which is calculating the Build Margin emission factor $EF_{BM,y}$ ex-ante.

- **STEP 3** – Calculate the baseline emission factor EF_y, as the weighted average of the operating margin factor ($EF_{OM,y}$) and the build margin factor ($EF_{BM,y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$ **Equation 10**

Where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{OM} = 0.5$). With these numbers:

$$EF_y = 0.5 \times 0.4749 + 0.5 \times 0.0903$$

- $EF_y = 0.2826\ tCO_2e/MWh$.

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 National Dispatch Center (*Operador Nacional do Sistema Elétrico, Centro Nacional de Operação do Sistema, Acompanhamento Diário da Operação do Sistema Iterligado Nacional*, daily reports from Jan. 1, 2002 to Dec. 31, 2004) supplied the raw dispatch data for the whole Brazilian interconnected grid. The following data sources were relevant for the calculation of the baseline:

- The Brazilian electricity system has been historically divided into two subsystems: the North-Northeast (N-NE) and the South-Southeast-Midwest (S-SE-CO). This is due mainly to the historical evolution of the physical system, which was naturally developed nearby the biggest consuming centers of the country.

The natural evolution of both systems is increasingly showing that integration is to happen in the future. In 1998, the Brazilian government was announcing the first leg of the interconnection line between S-SE-CO and N-NE. With investments of around US$700 million, the connection had the main purpose, in the government's view, at least, to help solve energy imbalances in the country: the S-SE-CO region could supply the N-NE in case it was necessary and vice-versa.

Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000):

"… where the Brazilian Electricity System is divided into three separate subsystems:

(i) The South/Southeast/Midwest Interconnected System;

(ii) The North/Northeast Interconnected System; and

(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

Moreover, Bosi (2000) gives a strong argumentation in favor of having so-called *multi-project baselines*:

"For large countries with different circumstances within their borders and different power grids based in these different regions, multi-project baselines in the electricity sector may need to be disaggregated below the country-level in order to provide a credible representation of 'what would have happened otherwise".

Finally, one has to take into account that even though the systems today are connected, the energy flow between N-NE and S-SE-CO is heavily limited by the transmission lines capacity. Therefore, only a fraction of the total energy generated in both subsystems is sent one way or another. It is natural that this fraction may change its direction and magnitude (up to the transmission line's capacity) depending on the hydrological patterns, climate and other uncontrolled factors. But it is not supposed to represent a significant amount of each subsystem's electricity demand. It has also to be considered that only in 2004 the interconnection between SE and NE was concluded, i.e., if project proponents are to be coherent with the generation database they have available as of the time of the PDD submission for validation, a situation where the electricity flow between the subsystems was even more restricted is to be considered.

The Brazilian electricity system nowadays comprises of around 91.3 GW of installed capacity, in a total of 1,420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5.3% are diesel and fuel oil plants, 3.1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1.4% are coal plants, and there are also 8.1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (Aneel, 2005. http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6.3 GW of the Paraguayan part of Itaipu Binacional, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

The Small Scale Approved Methodology I.D asks project proponents to account for "all generating sources serving the system". In that way, when applying this methodology, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

In fact, information on such generating sources is not publicly available in Brazil. The national dispatch center, ONS – *Operador Nacional do Sistema* – argues that dispatching information is strategic to the power agents and therefore cannot be made available. On the other hand, ANEEL, the electricity agency, provides information on power capacity and other legal matters on the electricity sector, but no dispatch information can be got through this entity.

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was contacted, in order to let participants know until which degree of detail information could be provided. After several months of talks, plants' daily dispatch information was made available for years 2002, 2003 and 2004.

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75,547 MW of installed capacity by 31/12/2004, out of the total 98,848.5 MW installed in Brazil by the same date (Aneel, 2005. http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76.4% (76.4%) of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23.6% (23.6%) are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

In an attempt to include all generating sources, project developers considered the option to research for available, but non-official data, to supply the existing gap. The solution found was the International Energy Agency database built when carrying out the study from Bosi *et al.* (2002). Merging ONS data with the IEA data in a spreadsheet, project proponents have been able to consider all generating sources connected to the relevant grids in order to determine the emission factor. The emission factor calculated was found more conservative when considering ONS data only (Table 12).

Table 12 - Ex ante and ex-post operating and build margin emission factors

(ONS-ADO, 2004; Bosi *et al.*, 2002)

Year	$EF_{OM\ non\text{-}low\text{-}cost/must\text{-}run}$ [tCO_2/MWh]		EF_{BM} [tCO_2/MWh]	
	Ex-ante	Ex-post	Ex-ante	Ex-post
2001-2003	0.719	0.950	0.569	0.096

Therefore, considering all the rationale explained, project developers decided for the database considering ONS information only, as it was capable of properly addressing the issue of determining the emission factor and doing it in the most conservative way.

The aggregated hourly dispatch data got from ONS was used to determine the lambda factor for each of the years with data available (2004, 2005 and 2006). The Low-cost/Must-run generation was determined according to ACM0002, through daily dispatch data provided by ONS. The table below shows the final results for the three considered years, as well as the lambda calculated.

Table 13 - Emission factors for the Brazilian South-Southeast-Midwest interconnected grid (simple adjusted operating margin factor)

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid

Baseline	EF_{OM} [tCO_2/MWh]	λ_y	Generation [MWh]
2006	0.8071	0.4185	315,192,117
2005	0.9653	0.5275	315,511,628
2004	0.9886	0.4937	301,422,617
	$EF_{OM,simple\text{-}adjusted}$ [tCO_2/MWh]	$EF_{BM,2006}$	Default EF_y [tCO_2/MWh]
	0.4749	0.0903	0.2826
	Alternative weights	Default weights	
	w_{OM} = 0.75	w_{OM} = 0.5	Alternative EF_y [tCO_2/MWh]
	w_{BM} = 0.25	w_{BM} = 0.5	0.379

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

Project participants decided to determine emission factor for interconnected grid *ex-ante*, without annual revision. Emission factor is calculated with data for the last available 3 years: 2004, 2005, 2006.

Data / Parameter:	$EF_{grid,y}$ ***and*** $EF_{electricity,y}$
Data unit:	tCO_2/MWh
Description:	CO2 emission factor for the Brazilian South-Southeast-Midwest interconnected grid
Source of data used:	Data provided by ONS (National dispatch center). Calculated according to the approved methodology – ACM0002, version 6, 2006
Value applied:	0.2826
Justification of the choice of data or description of measurement methods and procedures actually applied :	Factor was calculated according to the approved monitoring methodology ACM0002-ver06. Calculated as a weighted sum of the OM and BM emission factors.
Any comment:	

Data / Parameter:	***$EF_{OM,y}$***
Data unit:	tCO_2/MWh
Description:	CO_2 Operating Margin emission factor of the grid in a year *y*
Source of data used:	Data provided by ONS (National dispatch center). Calculated according to the approved methodology – ACM0002, version 6, 2006
Value applied:	0.4749
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to ACM0002, version 6, May 19, 2006, the option chosen for the calculation of the emission factor in this project is option (a): simple adjusted operating margin factor. This choice is due to the fact that, in Brazil, even though most of the energy produced in the country comes from hydroelectric power, most of these low costs investments in hydro electrics are exhausted. Therefore, the possibility of investments in non-renewable sources arises, such as thermoelectric power plants. As thermal plants use fossil, these companies end up having higher operational costs than hydro plants. As a result, they are likely to be displaced by any hydro added to the grid. See more details in Annex 3
Any comment:	

Data / Parameter:	***$EF_{BM,y}$***
Data unit:	tCO_2/MWh
Description:	CO_2 Build Margin emission factor of the grid in a year *y*
Source of data used:	Data provided by ONS (National dispatch center). Calculated according to the approved methodology – ACM0002, version 6, 2006
Value applied:	0.0903
Justification of the choice of data or description of measurement methods and procedures actually applied :	*ex-ante* calculation based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.
Any comment:	

Data / Parameter:	λ_y
Data unit:	No unit
Description:	Fraction of time during which low-cost/must-run sources are on the margin
Source of data used:	Data provided by ONS.
Value applied:	λ_{2004}=0.4185, λ_{2005}=0.5275, λ_{2006}=0.4937
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	

Data / Parameter:	***Fi,y***
Data unit:	Mass or volume

Description:	Amount of each fossil fuel consumed by each power source/plant
Source of data used:	Data provided by ONS
Value applied:	$$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$ Please see table below for data
Justification of the choice of data or description of measurement methods and procedures actually applied :	. Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	**COEFi**
Data unit:	tCO2/mass or volume
Description:	CO2 emission coefficient of each fuel type i
Source of data used:	Data provided by ONS.
Value applied:	$$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$ Please see table below for data
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	**GENj/k/n,y**
Data unit:	MWh/year
Description:	Electricity generation of each power source/plant *j*, *k*, or n in year *y*
Source of data used:	Data provided by ONS.
Value applied:	$$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$ Please see table below for data
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002

Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	**GENj/k/ll,y, Imports**
Data unit:	MWh
Description:	Electricity imports to the project electricity system
Source of data used:	Data provided by ONS.
Value applied:	$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$ Please see table below for data
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	**COEF i/j,y, imports**
Data unit:	tCO2/mass or volume unit
Description:	CO2 emission coefficient of fuels used in connected electricity systems (if imports occur)
Source of data used:	Data provided by ONS.
Value applied:	$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$ Please see table below for data
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according the approved methodology – ACM0002
Any comment:	As the amount of values/data is extraordinary large, it will be omitted here. Data is available under request, together with the emission factor for grid calculations.

Data / Parameter:	$\frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$
Data unit:	tCO2/MWh
Description:	Operating Margin for non low-cost/must run power sources *j*

Source of data used:	Data provided by ONS. Calculated according the approved methodology – ACM0002
Value applied:	2004: 0.9886 2005: 0.9653 2006: 0.8071
Justification of the choice of data or description of measurement methods and procedures actually applied :	Both electricity generated from power plants in the grid and electricity imported are included.
Any comment:	

Data / Parameter:	**Area**
Data unit:	km^2
Description:	Surface area at full reservoir level
Source of data used:	ANEEL Resolution nº. 2386 from July 27th, 2007.
Value applied:	0,64 km^2
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

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

$$ER_y = \left(EF_y \cdot EG_y\right)$$ **Equation 11**

Since the project activity is not adding renewable energy capacity, nor a retrofit of an existing facility, *EGy* (electricity production) = *TEy* (actual electricity produced in the plant)

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

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
2009 (from 1st January)	0	24,001	0	24,001
2010	0	24,001	0	24,001

2011	0	24,001	0	24,001
2012	0	24,001	0	24,001
2013	0	24,001	0	24,001
2014	0	24,001	0	24,001
2015 (Until 31st December)	0	24,001	0	24,001
Total (tonnes of CO_2e)	**0**	**168,007**	**0**	**168,007**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	***EGy***
Data unit:	MWh
Description:	Net electricity generation of the Project delivered to grid in a year y
Source of data to be used:	On-site measurements
Value of data	84,930
Description of measurement methods and procedures to be applied:	It consists in using meter equipment projected to registry and verify bi-directionally the energy generated by the facility. The meters installed in the plant are in accordance with the models stipulated by the Electricity Regulatory Agency (ANEEL) and the National Electric System Operator (ONS). This energy measurement is fundamental to verify and monitor the GHG emission reductions. This parameter is measured each 15 minutes and the consolidated measurements are monthly recorded. Credit owner and project operator, the special purpose company Rialma Companhia Energética III S.A. (listed under A.3. Project participants), is author and the responsible for all activities related to the project management, registration, monitoring, measurement and reporting.
QA/QC procedures to be applied:	The level of uncertainty of this data is low and will be used for calculate the emission reductions. The electricity generated by the plant will be cross-checked with data provided by CCEE - *Câmara Comercializadora de Energia Elétrica* (a Private and State owned company administrated by the Ministry of Mines and Energy) which controls and monitors the electricity available on the national interconnected grid.
Any comment:	This value corresponds to the net electricity generated by the plant. The internal consumption is estimated to be 3,480 kWh/month.

B.7.2 Description of the monitoring plan:

Monitoring plan is in accordance with the procedures suggested in the option (a) of Type I, Category D of CDM small-scale project activity categories contained in Appendix B of the simplified M&P for CDM small-scale project activity and applies to electricity capacity additions from small-scale run-of-river hydro power plants.

The monitoring plan shall consist of metering the electricity generated by the renewable technology. Credit owner and project operator, the special purpose company Rialma Companhia Energética III S.A. (listed under A.3. Project participants), is author and the responsible for all activities related to the project management, registration, monitoring, measurement and reporting.

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

Date of completing the final draft of this baseline section *(DD/MM/YYYY): 26/05/2006*.

Name of person/entity determining the baseline:

Company:	Ecoinvest Carbon Brasil Ltda.
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Country:	Brazil
Contact person:	(Mr.) Ricardo Esparta
Job title:	Director
Telephone number:	+55 (11) 3063-9068
Fax number	+55 (11) 3063-9069
Personal e-mail:	esparta@ecoinvestcarbon.com

Ecoinvest Carbon Brasil Ltda. is the Project Advisor and also a Project Participant.

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:

19/07/2007

The starting date of a CDM project activity is the earliest of the date(s) on which the implementation or construction or real action of a project activity begins/has begun whichever comes first.

In the PDD version used for the global stakeholders' consultation process, project start date was 10/01/2007, when the construction license renewal was requested to the environmental agency, which is the date when the PPs internally decided to proceed with the project activity. It is important to clarify that the issuance of the construction license can be renewed several times and does not incur in any obligation to build the project or in significant financial commitments.

Because during the validation of the project activity there was no official document attesting the acknowledgment from the environmental agency of request receipt (only project activity internal documents; Please refer to CAR 64 of the Validation Report), the PPs agreed with the DOE suggestion to set the project start date at the official indication of project activity start, the construction license issuance date, which was 10/08/2007. This was the project starting date considered in the PDD version first submitted for registration.

Nevertheless, the major equipments of the plant were bought before the issuance of the construction permit. The purchase contracts of the turbines and generators are dated from July 19th, 2007 and August 1st, 2007, respectively. Hence, 19/07/2007, date of signature of the purchase contract of the turbines, is the assumed starting date of the project activity[25].

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

30y-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:

The crediting period begins on 01/01/2009 or on the date of registration of the CDM project activity whichever is later. This date represents the one in which the plant is expected to become operational.

C.2.1.2. Length of the first crediting period:

7y-0m

[25] It shall be noted that the evidence of CDM consideration is from 2006 and, therefore, independently of the assumed project start date, it will be still applicable.

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. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

As for the environmental permits, the proponent of any project that involves the construction, installation, expansion, and operation of any polluting or potentially polluting activity or any activity capable of causing environmental degradation is required to secure a series of permits from the respective state environmental agency. In addition, any such activity requires the preparation of an environmental assessment report, prior to obtaining construction and operation permits. Three types of permits are required. The first is the preliminary permit (*Licença Prévia* or L.P.) issued during the planning phase of the project and which contains basic requirements to be complied with during the construction, and operating stages. The second is the construction permit (*Licença de Instalação* or L.I.) and, the final one is the operating permit (*Licença de Operação* or L.O.).

The preparation of an Environmental Impact Assessment is compulsory to obtain the construction and the operation licenses. In the process a report containing an investigation of the following aspects was prepared:

- Impacts to climate and air quality.
- Geological and soil impacts.
- Hydrological impacts (surface and groundwater).
- Impacts to the flora and animal life.
- Socio-economical (necessary infra-structure, legal and institutional, etc.).

From the environmental process perspective there are two types of small hydro projects: (a) those ones that only have to prepare a Preliminary Environmental Assessment ("*Relatório Ambiental Preliminar*", RAP) and (b) those ones that have to further set up assessments called Environmental Impact Study ("*Estudo de Impacto Ambiental*", EIA.) and Environmental Impact Assessment ("*Relatório de Impacto Ambiental",* RIMA). Later on, the local environmental agency can request another assessment called Basic Environmental Project ("*Projeto Básico Ambiental*", P.B.A.) for both types of project.

In order to start the process of obtaining environmental licenses every hydro project has to confirm that the following will not occur:

- Inundation of Indian lands and slaves historical areas;
- Inundation of environmental preservation areas;
- Inundation of urban areas;
- Inundation of areas where there will be urban expansion in the foreseeable 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 was considered environmentally feasible, the sponsors have to prepare the Preliminary Environmental Assessment ("*Relatório Ambiental Preliminar*" – R.A.P.), which is basically composed by the following information:

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

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:

The result of a successful submission of those assessments is the preliminary license (LP), which reflects the environmental local agency positive understanding about the environmental project concepts. To get the construction license (LI) it will be necessary to present either: (a) additional information into previous assessment; or (b) a new more detailed simplified assessment; or (c) the "Environmental Basic Project", according environmental local agency decision at the LP issued. The operation license (LO) will be obtained as result of pre-operational tests during the construction phase, carried out to verify if all exigencies made by environmental local agency were satisfied.

In order to obtain the construction license the project activity carried out an Environmental Impact Assessment on the principal impacts generated by the construction and operation of the proposed plant. The EIA – as agreed between the project owner and the environmental agency – covered other hydro power plants owned by the same company at that time in addition to Santa Edwiges III and was approved by AGMA (*Agência Goiana de Meio Ambiente*) in April, 2001. The principal impacts identified in this study and how they were taken into account is described below.

- **Community displacement**

This can be considered an extremely negative impact if there is the necessity to displace communities. However, once this is a small scale project that will occupy small areas already under control of the project participant, this impact can be neglected.

- **Landscape modification**

The region is characterized by a typical scenario of a huge access limitation. The reservoir can provide opportunities in leisure and tourism once the roads will be improved to the works execution.

- **Disappearance of forest vegetation**

This is estimated to happen when the reservoir is formed. There will be a significant loss of the vegetation that occurs along the river which will also probably affect the representative fauna. The plantation of a new forest in a protection area along the reservoir is intended to mitigate this negative impact.

- **Disturbances related to works**

The construction of the plant will probably attract people looking for job opportunities creating a higher demand for services in the involved cities. Nevertheless, there is a plan to provide the region with an adequate infra-structure which will be capable to absorb these external demands minimizing the negative consequences – all of them of limited duration – also favoring the economic development and the social well being.

In conclusion, it can be said that the plant is attractive from the perspective of using the natural resources to energy generation and is environmental acceptable once the proposed measures are implemented as suggested in the proposed plans and programs.

As requested by the local environmental agency a Basic Environmental Project was executed by **Naturae Consultoria Ambiental Ltda** aiming the mitigation of the possible impacts identified in the Environmental Impact Assessment and involves:

- Health and Environment Sanitation Program;
- Environmental Educational Program;
- Water Monitoring Program;
- Ictiofauna Monitoring Program;
- Rehabilitation of Degraded Areas Program;
- Cleanness of Degraded Basin Areas Program; and
- Fauna's Rescue Program.

The project has already obtained the construction license. The license was issued by the state environmental agency, AGMA (Agência Goiana de Meio Ambiente), LI number 258/2007 that was issued on August 10th, 2007. All documents related to operational and environmental licensing are public and can be obtained at the state environmental agency (AGMA-GO). Moreover, the project activity does not imply in transboundary environmental impacts and will not create any major adverse environmental effect.

As for the regulatory permits, Rialma S.A. - Centrais Elétricas Rio das Almas has the authorization issued by ANEEL (ANEEL Resolution n° 115, issued on April 5th, 2001) to operate as an independent power producer. This authorization was transferred to Rialma Companhia Energética S.A. (ANEEL Resolution nr 007, issued on January 12th, 2004) and more recently to Rialma Companhia Energética III S.A. (ANEEL Resolution nr 1249, issued on February 12th, 2008).

Additionally, the permits nr. 115 and 007 describe Santa Edwiges III as a power plant with 6.5 MW of installed capacity. During recent studies, it was reevaluated this capacity and a new permit to operate with 11.6 MW was issued on July 27th, 2007 (ANEEL Resolution nº. 2386).

SECTION E. Stakeholders' comments

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

The Brazilian resolution CONAMA 279 of June 2001 establishes that hydropower plants with less than 10 MW of installed power do not need to elaborate Environmental Impact Assessment (EIA). Santa Edwiges III Small Hydro Power Plant is an 11.6 MW hydropower plant. When it is necessary to elaborate the EIA, a public audience is also required.

However, the legislation requests the announcement of the issuance of the licenses (LP, LI and LO) in the local state official journal (*Diário Oficial do Estado*) and in the regional newspaper to make the process public and allow stakeholders' comments.

The public audience occurred during the process involved all the cities that somehow are affected by the project such as Mambaí and Buritinópolis. All comments were favorable to the project, since it is going to increase people's income and job offers.

It was also requested by the local environmental agency a Basic Environmental Project witch involves the following programs:

- Health and Environment Sanitation Program;
- Environmental Educational Program;
- Water Monitoring Program;
- Ictiofauna Monitoring Program;
- Rehabilitation of Degraded Areas Program; and
- Cleanness of Degraded Basin Areas Program.

Besides the stakeholders comments requested for the environmental licenses, the Brazilian Designated National Authority, "*Comissão Interministerial de Mudanças Globais do Clima*", requests comments from local stakeholders, and the validation report issued by an authorized DOE according to the Resolution no. 1, issued on 11th September 2003, in order to provide the letter of approval. The Resolution determines that copies of the invitations for comments sent by the project proponents at least to the following agents involved in and affected by project activities:

- 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;

Invitation letters were sent to the following agents on January 26th, 2007:

- *Prefeitura Municipal de Buritinópolis* (Buritinópolis City Hall)
- *Prefeitura Municipal de Mambaí* (Mambaí City Hall)
- *Câmara Municipal de Buritinópolis* (Municipal Assembly of Buritinópolis)
- *Câmara Municipal de Mambaí* (Municipal Assembly of Mambaí)
- *Agência Ambiental de Goiás* (State of Goiás Environmental Agency)
- *Secretaria do Meio Ambiente de Buritinópolis* (Buritinópolis Environmental Agency)
- *Secretaria do Meio Ambiente de Mambaí* (Mambaí Environmental Agency)
- *Ministério Público do Estado de Goiás* (State Attorney for the Public Interests of the State of Goiás)

- *FBOMS – 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)
- *Associação dos Pequenos Agricultores do Gerais* (Gerais Peasants Association)
- *Associação Comunitária dos Pequenos Produtores Agrícolas do Médio Nordeste Goiano* (Médio Nordeste Goiano Peasants Association)

Copies of the letters and post office confirmation of receipt communication are available upon request. The PDD of the project is open for comments at the validation stage in the United Nations Framework Convention on Climate Change website (http://www.unfccc.int/), since anyone can have access to the mentioned document from a legitimate source.

E.2. Summary of the comments received:

All comments in the public audience were favorable to the project once it is going to increase people's income and job offers. Since the operation permit was emitted, this is an evidence that the public audience took place and that there were no relevant comments concerning the project.

Regarding the invitation letters sent to the stakeholders, only FBOMS sent a letter suggesting the use of Gold Standard or similar tools so far.

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

All comments received in the licensing process were favorable, so that no due account was necessary to be taken. The project was developed as planned and following the requests made by the environmental agency and corresponding legislation. The research paper prepared by the Santa Edwiges III Small Hydro Power Plant Project analyzing the environmental impact of the plant in the region is available upon request.

Regarding the FBOMS comment, 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.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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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

Please refer to section B.6.1 for more detailed information.

Annex 4

MONITORING INFORMATION

In accordance with the procedures set by the Approved Methodology for Small Scale Activities, AMS.I-D – "Grid connected renewable electricity generation", monitoring shall consist of metering the electricity generated by the renewable technology.

The project will proceed with the necessary measures for the power control and monitoring. 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 regulates the electricity energy commercialization and is responsible for monitoring, on a monthly basis, the energy delivered to the grid. Additionally the National Electric System Operator (*from the Portuguese Operador Nacional do Sistema Elétrico* - ONS) established the procedures to measure and report the electricity generation by all the plants interconnected to the national grid[26].

Two energy meters, type ION 8600, are planned to be installed in Santa Edwiges III, one will work as the principal meter and the other will function as a back-up, in accordance to what ONS establishes. The meters used in Santa Edwiges III SHP have been successfully applied to similar projects in Brazil and around the world and have by legal requirements extremely low level of uncertainty (0.2 ANSI's accuracy class). They are going to be calibrated annually according to the specification of the company responsible for the automation of the plant.

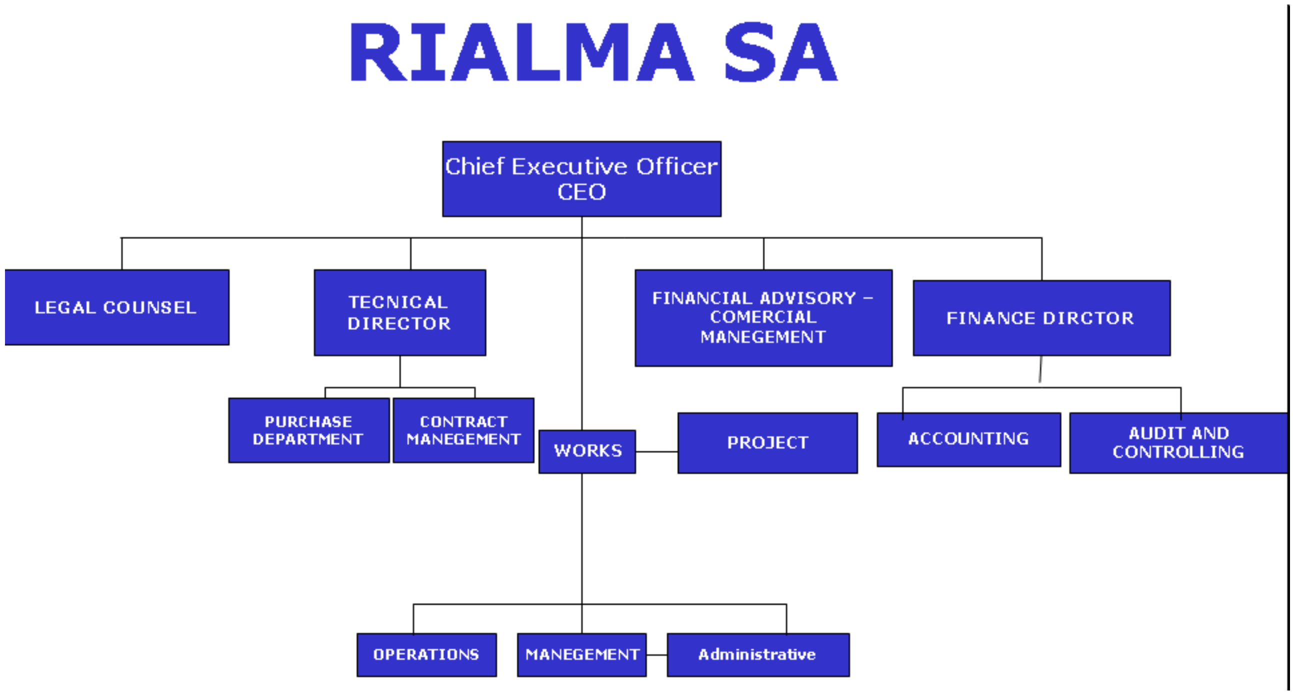
Measurements are controlled in real time by the SHP Digital System and in case of any problem, plant personnel will be put in action. There will be 4 operators directly supervising the plant working in a 6 hour shift each one. They are going to be supervised by an electric engineer. All the operations will be centralized in Brasilia, in the RIALMA's central office, which will operate and plan the maintenance of Santa Edwiges III SHP.

[26] For more details please refer to the document *Procedimento de Rede ONS – Módulo 12* available at http://www.ons.org.br/procedimentos/modulo_12.aspx

The information sent by the plant operators will be consolidated on a monthly basis and the central office will be the responsible to correctly save the information and retransmit to the energy distribution company. As a result, the generation information may be accessed and stored through at least two computers: the plant computer and the central office computer. There will be back-up procedures to ensure that the information will be properly archived during the crediting period plus two years.

The data to be archived, which is the generation information, is recorded in the meter's panels and in the computers installed in the SHPP. Moreover the information is also recorded by CCEE and CELG, the local concessionary, during an undetermined period. Finally as stated before, the information is archived in the central office where there is a back-up procedure which takes place each 2 months when the information is recorded and archived in CDs.

The commercial manager in charge of managing the CDM related activities. The plant operator is going to transmit the energy generation information to the commercial manager who will retransmit to the consultant in the verification moment. The figure below shows the company structure.

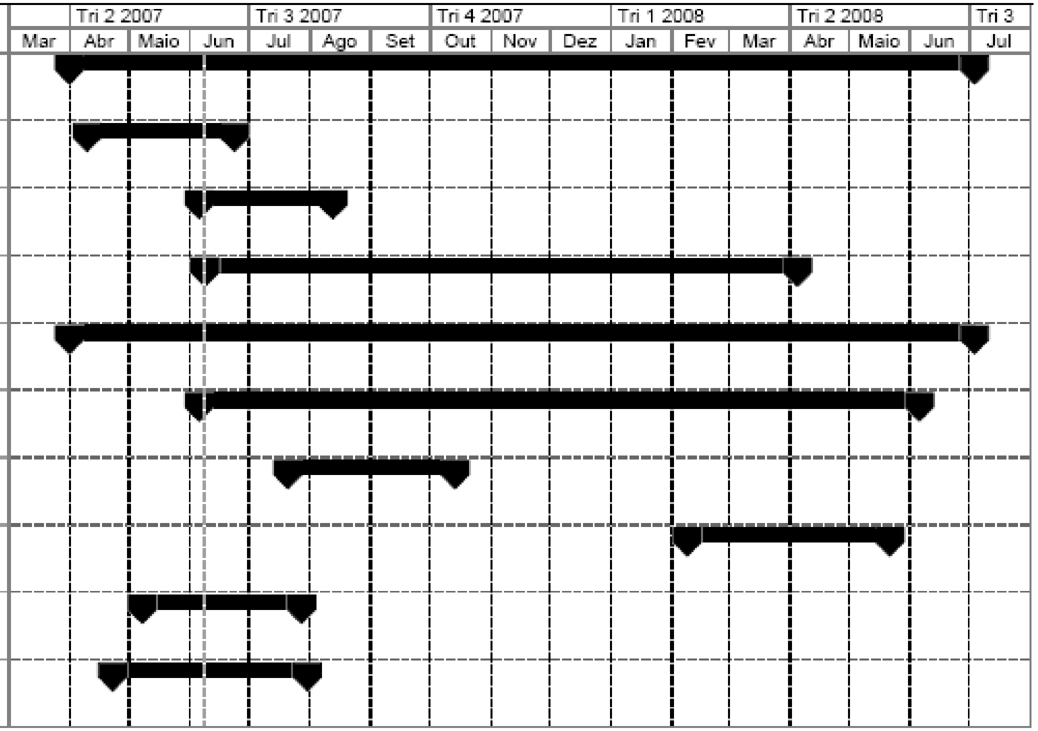


The SHP is responsible for the project management, as well as for organising and training of the staff in the appropriate monitoring, measurement and reporting techniques according to the determinations of the equipments suppliers. The energy distribution company will be defined before the SHP becomes operational.

Annex 5

TENTATIVE SCHEDULE

Id	Name of the task	Duration
1	PCH Santa Edwiges III	460 days
2	Preliminary Works	75 days
7	Jobsite	68 days
18	Power House - Structure	301 days
34	Power House - Electric completion	460 days
45	Dam	366 days
50	Diversion tunel	85 days
53	Penstock	103 days
57	Substation	81 days
64	Transmission Line	99 days



Annex 6

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Annex 7

DOCUMENTS PRESENTED DURING THE REQUEST FOR REGISTRATION

Project Participants' initial comments to the request for review and clarifications provided in the review process during the request for registration of the Project Activity are attached to ensure all information provided is included in the PDD.

The most relevant parts of these documents were included in section B.5. Additionally, all documents evidencing additional information mentioned in PP's answers were provided to the DOE during the process of revision of the proposed project activity.

São Paulo, 26 February 2009

Request for Review for "Rialma Companhia Energética III S/A. – Santa Edwiges III Small Hydro Power Plant – Small Scale CDM Project" (2165)

Notification (e-mail message) received on 12 February 2009

Though the request is addressed to the DOE, Project Participants believe that the below provided information is helpful to address the raised issues. Requests 1, 2 and 3 ask for the same information and PPs initial comments to the raised issues are presented below.

1. *The DOE shall confirm the project starting date as the validation report (p12) refers to 19 July 2007 (when the turbine purchase contract was signed) while section C.1.1 of the PDD (p44) refers to 10 August 2007 (when the construction license was issued).*

During the completeness check of the project activity by the Executive Board, it was asked to include a proper justification for the starting date of the project activity in section C.1.1. Project Participants revised the document and forwarded the new version of the PDD to the DOE, still considering 10 August 2007 as *project starting date*.

However, the DOE requested to change the date to the one on which the turbines were ordered. A new PDD version was then issued, considering 19 July 2007 as the starting date of the project activity. This new version was sent to the validating DOE on 9 January 2009.

Project Participants did not check the version submitted for registration and believe that, due to a misunderstanding, an older version was submitted for registration. To avoid new misunderstandings, the correct PDD version is being resubmitted..

2. *The DOE shall clarify how it has validated the IRR calculations according to paragraphs 3 (period of assessment), 8 (formulas used in the spreadsheet) and 17 (sensitivity analysis) of EB 41, Annex 45 guidance.*

a) The period of assessment considered in the project's cash flow was 12 years because this is the longest term of the financing lines the project developer could obtain when the decision took place..

The financing lines that were considered by the project developer were: 1) *FCO Empresarial*, 2) *BNDES automático* and 3) *FINAME*[1]. The maximum terms established by these programmes are 12 years, 144 months and 60 months, respectively[2].

[1] It is only eligible for financing equipment.

[2] Iformation about the maximum period of the financing lines are publicly available. For FCO Empresarial <http://www.bb.com.br/portalbb/page100,106,3046,10,1,1,2.bb?codigoMenu=331&codigoNoticia=2243&codi

During the validation process, the DOE asked project participants to increase the period to be consistent with the WACC calculation, e.g. 15 years. This is consistent with paragraph 3 of the guidance that establishes that (…) *the period of assessment should not be limited to the proposed crediting period of the CDM project activity, (…) include the fair value of the project activity assets at the end of the assessment period, (…) and a minimum period of 10 years and a maximum of 20 years will be appropriate.*

b) As per paragraph 8 of the guidance the files provided to the DOE regarding the investment analysis contained all formulas in a readable format and all relevant cells were viewable and unprotected, which are the sum of all revenues and expenses and the calculation of project's IRR.

c) The sensibility analysis, as established by the Guidance, is to be conducted considering variables that constitute more than 20% of either total project costs or total project revenues. Hence, any variation only can be done increasing project's revenues (sale of electricity), reducing financing expenses and reducing operation and maintenance costs.

Also according to the guidance, "*variations in the sensitivity analysis should at least cover a range of +10% and -10%, unless this is not deemed appropriate in the context of the specific project circumstances*".

The benchmark used to evaluate the probability of variation in the energy price was the price observed in the government's auction. According to the Chamber of Electrical Energy Commercialization (CCEE – *Câmara de Comercialização de Energia Elétrica*) *the criterion of the least tariff is used to define the winners of a given auction, that is, the winners of the auction shall be those bidders which offer electric power for the least price per Mega-Watt Hour to supply the demand envisaged by the Distributors*.

As mentioned in the PDD, in 2007 two actions were conducted by CCEE. One of these auctions procured only alternative renewable sources of energy, like the one the proposed project activity is to provide. Regarding small hydropower plants the highest price obtained was BRL 135.00/MWh. Among the 6 plants that sold the energy in this action the lower price was BRL 134.97/MWh.

This minimum difference between the highest and lowest prices of the action evidences that any variation of the energy price in the country at that moment wasn't expected. The Power Purchase Agreements signed after the actions are for long term and have low risk. As a consequence, contracts that are signed apart from auctions naturally take these results into account.

The below table provides the results of the past auctions, from the *First Auction of "New Energy"* until the *Fifth Action of "New Energy"* and the *Renewable Sources Auction*. The prices in this table were taken from the results of the auctions that occurred until 2008 and these are the prices that are going to be paid for the plant from the sources considered from 2008 on.

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goRet=1057&bread=3>; for BNDES automático < http://www.bndes.gov.br/linhas/bndesaut.asp> and for FINAME < http://www.bndes.gov.br/linhas/finame.asp>.

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Table 1 – Energy Price in the Brazilian regulated market.

		Hidro	Biomass	NG	Coal	Oil	Total
2008	MWmed	71	31	352	0	178	632
	MWh	622.358	271.734	3.085.491	0	1.560.277	5.539.859
	R$/MWh	106,95	111,04	131,00	0,00	138,44	129,42
2009	MWmed	1074	110	479	0	642	2.305
	MWh	9.414.254	964.216	4.198.722	0	5.627.515	20.204.708
	R$/MWh	124,38	133,80	127,25	0,00	134,77	128,32
2010	MWmed	935	140	570	292	1304	3.241
	MWh	8.195.836	1.227.184	4.996.392	2.559.555	11.430.342	28.409.310
	R$/MWh	115,48	138,85	120,35	124,67	134,67	125,90
2011	MWmed	569	61	400	0	74	1.104
	MWh	4.987.626	534.702	3.506.240	0	648.654	9.677.222
	R$/MWh	121,86	137,10	137,44	0,00	137,72	129,41
2012	MWmed	715	0	351	930	316	2.312
	MWh	6.267.404	0	3.076.726	8.152.008	2.769.930	20.266.067
	R$/MWh	129,14	0,00	129,34	126,97	131,40	128,61
Total	MWmed	**3.364**	**342**	**2.152**	**1.222**	**2.514**	**9.594**
	MWh	**29.487.478**	**2.997.835**	**18.863.571**	**10.711.563**	**22.036.718**	**84.097.166**
	Share	**35,1%**	**3,6%**	**22,4%**	**12,7%**	**26,2%**	**100,0%**
	R$/MWh	**122,12**	**134,39**	**128,27**	**126,42**	**134,64**	**127,77**

Source: Modified from ESPARTA, 2008[3].

As it can be seen, the price considered in the decision making context is reasonable and conservative when the historic prices are analysed. As mentioned in the PDD, project's IRR only equals the company's WACC when the energy price is BRL 145/MWh. From the above it is not reasonable admit that this variation will occur.

Another way of increasing project's revenues is increasing energy generation. However, this is not expected to happen because the electricity generation estimative is based on the assured energy established by ANEEL (ANNEL Resolution nr 28 dated October 23rd, 2007). This number is established based on hydrological data of the river, considering several years. In conclusion the energy generation of the plant is not expected to increase.

Reduction in investment costs of 7% equals project's IRR to the company's WACC. In this case a probability assessment on the investment variation should be carried according to the Guidance on the Assessment of Investment Analysis: "*In cases where a scenario will result in the project activity passing the benchmark or becoming the most financially attractive alternative the DOE shall provide an assessment of the probability of the occurrence of this scenario in comparison to the likelihood of the assumptions in the presented investment analysis.*"

The assessment on the probability of the occurrence of investment costs reduction was based on two other CDM registered projects developed by other companies owned by the same project developer (Table 2). These projects represent the only experience of the project developer on similar

[3] ESPARTA, A.R.J. **Redução de emissões de gases de efeito estufa no setor brasileiro: a experiência do Mecanismo de Desenvolvimento Limpo do Protocolo de Quioto e uma visão futura.** Tese de doutorado - Programa Interunidades de pós graduação em energia - EP/FEA/IEE/IF da Universidade de São Paulo. 2008

projects. The audited invested amounts and forecasted amounts in the moment the decision to build the plants was taken have been compared to show the deviations from Santa Edwiges III's forecasts. The Normal Distribution has been adopted.

Table 2 – Investment and forecasted investment of other two projects owned by the investor.

Project	Investment Forecast[4]	Invested[5]
Santa Edwiges I	43.551.959	43.319.842
Santa Edwiges II	38.288.212	42.967.541

It has been calculated the probability of a 7% reduction in investments, which equals the benchmark to the project IRR for investment sensitivity. The cumulative normal distribution for a 7% reduction in investments is 6.6%. It means that only in 6.6% of the cases there will be a reduction of 7% or greater in the investments related to the investment forecasts (Annex 1).

Therefore it is not likely, as shown by the Normal Distribution, that an investment reduction of 7% would occur based on the project developer previous experiences.

Finally, the variation of operation and maintenance cost has to be evaluated. Only a reduction in these costs could favour the project increasing its IRR above the WACC. Then, the 10% of variation, as recommended by the guidance can be applied. The result is that the project's IRR, when reducing 10% of the operating and maintenance costs, is 16.05% (Annex 2).

Hence, Project Participants consider that the presented sensitivity analysis is conservative and the occurrence of a scenario other than the scenarios presented is very unlikely.

3. *The DOE shall provide a clear validation opinion of the barriers presented for the project activity.*

The assessment and demonstration of additionality was concentrated in the investment benchmark analysis option (option III). Section 3 (barrier analysis) was also presented to stress the conservativeness of a benchmark assumption.

Regardless of how clear it is that the mentioned barriers influence investment decisions, it is impossible to classify such barriers as prohibitive. Therefore, the barrier analysis is provided here as anecdotal evidence, supporting the benchmark investment analysis. The investment analysis shows that the project activity is not financially attractive to the investor. And the barrier analysis is added to the PDD in order to show that not only the pure numbers of the financial analysis must be taken into account, when investing in a project.

Confident that the above initial comments help to adequately address the raised issue we remain available at any time for additional clarifications.

[4] The investment forecast is available at UNFCCC's webpage. For Santa Edwiges I project the cash flow can be downloaded at <http://cdm.unfccc.int/Projects/DB/BVQI1167141448.3/view>. Santa Edwiges II cash flow is available at <http://cdm.unfccc.int/Projects/DB/BVQI1167161981.54/view>.

[5] Values provided by audited balance sheets of the SPCs.

Best regards,
For the Project Participants

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São Paulo, 9 April 2009

Clarifications on issues associated with validation requirements for project activity under review

"Rialma Companhia Energética III S/A. - Santa Edwiges III Small Hydro Power Plant - Small Scale CDM Project" (2165)

SCOPE: **A review to determine the additionality of the project activity through an assessment of the investment analysis as the approaches used by the PP in the sensitivity analysis, for tariff and total investment, are not accepted by the DOE.**

Request for clarification to the PP/DOE:

Context:

- The request for review sought clarification from the DOE on how it had validated the IRR calculations according to paragraphs 3 (period of assessment), 8 (formulae used in the spreadsheet) and 17 (sensitivity analysis) of EB 41, Annex 45 guidance. The PP responses explained that the period of assessment is of 15 year, and that a residual value of the asset is assumed at the end of this period. The 15 year period is longer than the 12 year loan. The spreadsheet with the details (formulae) of the IRR calculation has been submitted with the responses. The DOE validated the responses regarding paragraphs 3 and 8 as correct and appropriate. Regarding paragraph 17 the PP stated that: (a) the submitted sensitivity analyses apply ± 10% changes in O&M costs; (b) the electricity generation cannot be changed as it is based on hydrological data, the PLF is 83.6%; (c) the applied tariff of 133.63 BRL/MWh is unlikely to exceed 145 BRL/MWh (which then crosses the WACC benchmark of 17.4%) as the highest auction data from 2008 to 2012 for similar small hydropower projects in Brazil is 135 BRL/MWh; and (d) the investment costs would need to be reduced by 7% to reach the benchmark and this is not possible based on the PPs' experiences in other two CDM hydropower plants. The DOE has validated that the changes in the O&M costs and electricity generation would not affect the project IRR. However, the DOE does not agree with the analysis of the tariff, as it is based on auction data from 2008-2012 and not on historical data or the investment costs, as it is based on data from two projects which is not comparable to the project activity.

Questions:

1. The PP is requested to further substantiate the possible changes of tariff and investment in the sensitivity analysis, as the approaches used by the PP are not agreed by the DOE.

2. The DOE should validate the sensitivity analysis of tariff and total investment in the investment analysis, and to provide a clear opinion on the additionality of the project activity.

Clarifications to Question 1 - The PP is requested to further substantiate the possible changes of tariff and investment in the sensitivity analysis, as the approaches used by the PP are not agreed by the DOE.

To avoid misunderstandings it shall be clearly stated that the approaches not agreed by the DOE in its initial comments are related to additional information freely[1] supplied by the project participants (PPs) in the request for review process.

Moreover the PPs confirm that the DOE did an extremely thorough validation of the project activity, exhaustively questioning[2] the approaches used by the PPs in the investment and sensitivity analysis.

However, the PPs recognize that due to the short time span available it is not always possible to fully validate additional information supplied while responding to request for review and review questions. The project participants are fully committed to further supply evidences to estimated figures, for example project costs still to incur during the first semester of 2009, as soon as they are paid and third parties receipts are available.

Still with respect to recent/actual data presented to confirm estimates at the time of the investment decision is taken by the project participants (19/07/2007 in the case of the project activity), the project participants understand that data shall be used only as a good indication of trends because according to the applicable guidance at the validation time, (EB39-Annex 35):

> "input values used in all investment analysis should be valid and applicable at the time of the investment decision is taken by the project participants. The DOE is therefore expected to validate the timing of the investment decision and the consistency and appropriateness of the input values with this timing. The DOE should also validate that the listed input values have been consistently applied in all calculations."

It is the PPs understand that for the sensitivity analysis, being also part of the investment analysis, the guidance above also applies.

While providing the evidences the PPs took into account the following guidance from the "Combined tool to identify the baseline scenario and demonstrate additionality":

> The type of evidence to be provided should include at least one of the following:
>
> (a) Relevant legislation, regulatory information or industry norms;
>
> (b) Relevant (sectoral) studies or surveys (e.g. market surveys, technology studies, etc) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc;

[1] It is important to mention that none of the questions in the request for review was addressed to the PPs.

[2] Nine of sixty eight corrective action requests (13, 16, 44, 45, 46, 48, 56, 57 and 68), including two directly related to the sensitivity analysis (16 and 45), and four of eight clarification requests (2, 3, 6 and 8) are related to the investment and sensitivity analysis were raised and adequately closed during the validation process.

(c) Relevant statistical data from national or international statistics;

(d) Documentation of relevant market data (e.g. market prices, tariffs, rules);

(e) Written documentation from the company or institution developing or implementing the CDM project activity or the CDM project developer, such as minutes from Board meetings, correspondence, feasibility studies, financial or budgetary information, etc;

(f) Documents prepared by the project developer, contractors or project partners in the context of the proposed project activity or similar previous project implementations;

(g) Written documentation of independent expert judgements from industry, educational institutions (e.g. universities, technical schools, training centres), industry associations and others.

Regarding the first part of the review request for clarifications, the tariff in sensitivity analysis, in the next paragraphs the PPs use the information supplied during the validation process and included in the PDD but also additional information (given preference to readily available public information) to further subsidize the validation conclusion.

According to the PDD, page 17:

The validated project's IRR was calculated considering the energy price of BRL 133.62/MWh... it was estimated the price in which the project's IRR would be equal to the company's WACC as being equal to BRL 145.00/MWh.

As mentioned in the PDD two public actions[3] were carried out in 2007 by the time of the project start date by the Brazilian Chamber of Electrical Energy Commercialization (CCEE, from the Portuguese "Câmara de Comercialização de Energia Elétrica") for electricity to be dispatched from 2010 onwards. An introduction to the role of the CCEE in the Brazilian power sector follows[4]:

In 2004, Law 10.848 implemented the New Model for the Power Sector and authorized the creation of the Electric Power Commercialization Chamber – CCEE – which is regulated by Decree 5.177, dated August 12th, 2004. CCEE is a not-for-profit, private, civil organization company in which Agents are gathered in three Categories: Generation, Distribution, and Commercialization.

The purpose of CCEE is to carry out the wholesale transactions and commercialization of electric power within the National Interconnected System... These activities form the Energy Accounting and Financial Settlement Process, which is entirely audited by outside auditors, pursuant ANEEL's Normative Resolution nº 109, dated October 26th, 2004 (Electric Power Commercialization Convention).

One of the auctions carried out in 2007 (on 26 July), open to all sources of energy (including hydro, wind and biomass, a file named "Evidence 1-2007 auction qualified projects.pdf" with the list of projects with clearance to participate in the auction is supplied attached to the present document),

[3] Official documents are publicly available at http://www.epe.gov.br/leiloes/Paginas/default.aspx (site accessed on 03.04.2009).

[4] Source: http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=92f6a5c1de88a010VgnVCM100000aa01a8c0RCRD (site accessed on 9 April 2009).

resulted in the commercialization of 1304 MW-average (electricity) and 1701.8 MW installed capacity (power)[5] from 12 projects. Table 1shows individual results of the 26 July 2007 auction. The prices indicated in the table is the actual price (tariff) paid in long-term contracts (at least 15 years) for projects dispatching electricity into the grid from 2010 onwards.

Project	source	Energy (MW-average)	Price (BRL/MWh)
Campina Grande	residual fuel oil	119	132.83
Global I	residual fuel oil	105	135.90
Global II	residual fuel oil	109	135.90
Nova Olinda	residual fuel oil	120	136.00
Tocantinópolis	residual fuel oil	120	135.90
Itapebi	residual fuel oil	103	133.60
Monte Pascoal	residual fuel oil	104	132.80
Termocabo	residual fuel oil	38	134.80
Termonordeste	residual fuel oil	123	135.97
Termoparaiba	residual fuel oil	123	135.92
Maracanau I	residual fuel oil	119	133.13
Viana	residual fuel oil	121	133.21
weighted average price =			**134.67**

Table 1 - Electricity commercialized in the 26 July 2007 auction

The prices results from the auctions (presented in Table 1, Table 2 and, Table 3) are the actual tariff paid to the power producers, i.e., the value to be used as input in the investment analysis.

The other auction carried out in 2007 (on 18 June), open only to alternative energy sources (small-hydro, wind and biomass), resulted in the commercialization of 185 MW-average (electricity) and 638.64 MW installed capacity (power)[6]. Table 2 shows individual results of the 26 July 2007 auction.

[5] Official documents are publicly available at http://www.epe.gov.br/leiloes/Paginas/default.aspx?CategoriaID=42. Summary of the auction results in Portuguese downloaded from the above mentioned web-page is supplied in attached file named “Evidence 2-New energy auction press release.pdf”.

[6] Official documents are publicly available at http://www.epe.gov.br/leiloes/Paginas/default.aspx?CategoriaID=43. Summary of the auction results in Portuguese downloaded from the above mentioned web-page is supplied in attached file named “Evidence 3-Alternative sources auction press release.pdf”.

Project	Source	Energy (MW-average)	Price (BRL/MWh)
Ester	biomass	7	138.90
Flórida Paulista	biomass	8	139.12
Icanga	biomass	4	138.94
Louis Dreyfus Lagoa da Prata 1	biomass	13	139.12
Louis Dreyfus Lagoa da Prata 2	biomass	6	139.12
Louis Dreyfus Rio Brilhante 1	biomass	10	139.12
Louis Dreyfus Rio Brilhante 2	biomass	12	139.12
Pioneiros II	biomass	12	139.12
Santa Cruz AB 1	biomass	6	138.75
Santa Cruz AB 2	biomass	14	138.75
São João da Boa Vista	biomass	23	138.60
Xanxerê	biomass	25	138.50
Arvoredo	hydro	7	135.00
Ibirama	hydro	13	134.98
Pampeana	hydro	5	135.00
Pedra Furada	hydro	3	134.97
Santa Luzia Alto	hydro	14	135.00
Varginha	hydro	4	135.00
		weighted average price =	**137.90**

Table 2 - Electricity commercialized in the 18 June 2007 auction

The highest price paid to the 30 selected projects in the two auctions shortly before the project start date was BRL 139.12/MWh, and the highest price paid to a small hydropower plant was BRL 135.00/MWh from 18 projects.

The results of the two public auctions unequivocally show that a project offering electricity to be dispatched into the Brazilian Interconnected System BRL 145/MWh (which would cross the project activity WACC benchmark of 17.4%) from January 2009 onwards (forecasted project operation start) would not be selected in the public auctions.

If the analysis is widened to include all energy contracted in auctions to be dispatched between 2008 and 2012 (see Table 3[7]) the conclusion is the same, namely, it is very unlikely to obtain a tariff above BRL 145 while the official public governmental auctions clearly indicate averages from BRL 122.12 to BRL 134.64 (see Table 3) and R$ 140 as a market upper limit (see Table 2). It shall be noted that the year indicated the price paid to projects with operation start at that particular year and 15-year contracts (at least) are offered to the selected projects. Another conclusion that may be taken from the Table 3 is that for hydropower projects with operation start from 2008 to 2012 no unequivocal trend of increasing or decreasing prices can be seen (BRL 106.95 in 2008, BRL 124.48 in 2009 the year of the operation start of the project activity; BRL 115.48 in 2010, BRL 121.86 in 2011, 129.14 in 2012) and that all average prices in the whole period are below BRL 133.63 used in the investment analysis and significantly smaller than the break even value of BRL 145.

[7] Source: ESPARTA, A.R.J. (2008). *Redução de emissões de gases de efeito estufa no setor brasileiro: a experiência do Mecanismo de Desenvolvimento Limpo do Protocolo de Quioto e uma visão futura.* PhD Thesis, Programa Interunidades de Pós graduação em energia - EP/FEA/IEE/IF da Universidade de São Paulo (available at http://www.teses.usp.br/teses/disponiveis/86/86131/tde-29042008-160752/, site accessed on 3 April 2009).

		Hydro	Biomass	Natural Gas	Coal	Residual fuel oil	Total
2008	MW-average	71	31	352	0	178	632
	MWh	622,358	271,734	3,085,491	0	1,560,277	5,539,859
	BRL/MWh	106.95	111.04	131.00	0.00	138.44	129.42
2009	MW-average	1074	110	479	0	642	2,305
	MWh	9,414,254	964,216	4,198,722	0	5,627,515	20,204,708
	BRL/MWh	124.38	133.80	127.25	0.00	134.77	128.32
2010	MW-average	935	140	570	292	1304	3,241
	MWh	8,195,836	1,227,184	4,996,392	2,559,555	11,430,342	28,409,310
	BRL/MWh	115.48	138.85	120.35	124.67	134.67	125.90
2011	MW-average	569	61	400	0	74	1,104
	MWh	4,987,626	534,702	3,506,240	0	648,654	9,677,222
	BRL/MWh	121.86	137.10	137.44	0.00	137.72	129.41
2012	MW-average	715	0	351	930	316	2,312
	MWh	6,267,404	0	3,076,726	8,152,008	2,769,930	20,266,067
	BRL/MWh	129.14	0.00	129.34	126.97	131.40	128.61
Total	MW-average	**3,364**	**342**	**2,152**	**1,222**	**2,514**	**9,594**
	MWh	**29,487,478**	**2,997,835**	**18,863,571**	**10,711,563**	**22,036,718**	**84,097,166**
	Share	**35.1%**	**3.6%**	**22.4%**	**12.7%**	**26.2%**	**100.0%**
	BRL/MWh	**122.12**	**134.39**	**128.27**	**126.42**	**134.64**	**127.77**

Table 3 - Electricity contracted in public auctions to be dispatched between 2008 and 2012

To confirm that the breakeven value of BRL cannot be obtained three receipts of spot-market energy sales in the beginning of 2009 (evidences 3a, 3b and 3c) are supplied. The evidences show the sale of 2,232 MWh at BRL 140.00, 3,335 MWh at BRL 83.64 and, 7,0845 MWh at BRL 75.00, determining a weighted average price of BRL 88.64, i.e., 39% below the breakeven value.

All supporting evidences are supplied in its original form (full documents as downloaded from the referenced public web-pages) in Portuguese due to the very short time to respond the clarification request and large amount of documents. The project participants are available to translate any part of the supplied evidences into English.

Concerning the second part of the review request for clarification, investment in sensitivity analysis, in the next paragraphs the PPs will also use the information supplied during the validation process and included in the PDD but also additional information (given preference to readily available public information) to further subsidize the validation conclusion, namely, an investment cost reduction of 7% needed to reach the benchmark is very unlikely.

It is the understanding of the PPs that the best source to support any statement about changes in the estimated investment is their own experience.

The PPs already implemented two CDM small hydropower plants, Sta Edwiges I (CDM 0830[8]) and Sta Edwiges II (CDM 0831[9]). The estimated investment for both projects (BRL 43,319,842 for Sta Edwige I and BRL 42,967,541 for Sta Edwiges II) are released in the registered PDD appendices containing the cash flow information. The actual investment in both projects come from the audited balances attached to the present document (files named “Evidence 4-Balance Rialma I.pdf” and “Evidence 5-Balance Rialma II.pdf”).

[8] http://cdm.unfccc.int/Projects/DB/BVQI1167141448.3/view.
[9] http://cdm.unfccc.int/Projects/DB/BVQI1167161981.54/view.

Likewise the estimated cost for Sta Edwiges III (CDM 2165[10], the present project activity) is released in the validated cash flow (BRL 57,883,392, see appendix 1 to the PDD). The actual investment can only be estimated as all the expenses of the project are not disbursed yet. The most recent version of the 2008 balance (files "Evidence 6-Balance Rialma III-confidential.xls" and "Evidence 6a-Balance Rialma III.xls[11]" attached) shows already disbursed BRL 51,934,309.74 at the end of 2008. As there are around BRL 8,000,000 forecasted disbursement, the final cost can be estimated with low degree of uncertainty to be around BRL 59,900,000. To give an idea of the additional investments, in the 2008 balance one can see already committed costs (cash and advance payments) in the order of BRL 3,317,718. Furthermore many equipments and service suppliers foresee closing payments after the projects commissioning in January 2009. Examples are given of the generators and automation (evidences 12, 13 and 14) summing BRL 1,094,000. Summarizing, with the presented evidences the amount of BRL 56,396,027 (97.4% of the initially estimated costs) is already disbursed confirming that a 7% reduction is already not achievable even without the estimated additional BRL 3,500,000 to be accounted in the first semester of 2009 (post commissioning costs, for example, wages and layoff expenses of the civil workers; analogous to December 2008, see evidence 15).

The presented numbers are also summarized in the file called "evidence 6-Balanco Rialma III.xls".

Table 4 summarizes the PPs experience while implementing the small hydropower plants.

	Estimated investment	Actual investment	diff
Sta Edwiges I	BRL 43,319,842	BRL 43,551,959	0.54%
Sta Edwiges II	BRL 42,967,541	BRL 40,463,354	-5.83%
Sta Edwiges III	BRL 57,883,392	BRL 59,900,000	3.48%

Table 4 – Project participants experience with small hydropower plants experience

The numbers show that although a reduction in investment expenses is according to the PPs experience possible, achieving 7% reduction is rather unlikely.

Data from another project developer (confidential cash flow information supplied to the DOE, spreadsheets "evidences 8" and "evidence 9") show a forecasted investment of BRL 213,048,000 for two SHPs with operation start in 2008 (total of 54 MW installed capacity) and actual investment of BRL 226,008,189 (6% above the estimated), confirming the more likely trend of actual costs above the initially estimated investment.

The conclusions corroborate per review literature findings related to the estimation of construction costs and schedules in developing countries (see file "Evidence 7-EnergyPolicy article.pdf" attached). Using a sample of 125 projects (59 thermal and 66 hydropower) Bacon and Besant-Jones (1998)[12] show that although the ratio of actual to estimated cost can be smaller than

[10] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218634643.54/view.

[11] .See file named "Evidence 6b-Balance legal status.doc", with an expert opinion from an external source confirming that the presented balances audited and approved by the project activity finance director and chartered accountant is an official and legal document in conformity with the applicable Brazilian legislation.

[12] R. W. Bacon and J. E. Besant Jones (1998). *Estimating construction costs and schedules – Experience with power generation projects in developing countries.* Energy Policy, vol. 26, no 4, pp 317-333.

one (indicating actual investment smaller than estimated), less than 10% of the analysed projects disbursed less than forecasted. One of the conclusions of the paper is that "the estimated values were significantly biased below actual values".

In order to further confirm the conclusion the PPs contacted the Brazilian Association for the Small and Medium Electrical Energy Producers (APMPE, from the Portuguese "Associação Brasileira dos Pequenos e Médios Produtores de Energia Elétrica") asking for an expert opinion.

The answer from APMPE's president, Mr. Ricardo Pigatto (attached file "Evidence 10-Email APMPE.doc"). In summary Mr. Pigatto corroborates that the likelihood of higher actual than estimated costs is elevated. To confirm the statement Mr Piggato reminds that the "Guidance for Small Hydropower Plants Studies and Projects"[13] prepared by the state owned Federal Power Utility Eletrobras (Centrais Eletricas Brasileiras S.A.) recommends in its Annex 3 (attached file "Evidence 11-Eletrobras standard quotation.xls") to add 5% on the top of estimated for unforeseen expenses. The PPs confirm that the presented estimated costs for the project activity do not include any cost for unforeseen expenses.

From the above information and the attached evidences the PPs are confident to state that a reduction in the project activity investment expenses in unlikely and a reduction of 7% in investments costs is very unlikely.

Clarifications to Question 2 The DOE should validate the sensitivity analysis of tariff and total investment in the investment analysis, and to provide a clear opinion on the additionality of the project activity.

To be completed by the DOE.

Confident that the above clarifications adequately address the raised issues we remain available at any time for additional clarifications.

Best regards,
For the Project Participants

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[13] Available at http://www.eletrobras.gov.br/EM_Atuacao_Manuais/default.asp (site accessed on 3 April 2009).