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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

UHE Mascarenhas power upgrading project

Version 04 PDD completed on 01/03/2007.

A.2. Description of the project activity:

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

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

The project activity carried out by *Energest*[1]*/EDP* will use the existing hydro power scheme and the existing electric infrastructure to increase the amount of generated energy through the installation of a new Kaplan turbine with no environmental impacts at the water reservoir, thus optimizing the water flow that would be otherwise inefficiently released at the reservoir dam. Under the project activity, the level of the reservoir will not be changed (increased or decreased) and the new hydro turbine will optimize 269 m3/s that will generate a total amount of 200,604 MWh[2], or working a total time of 4,052 hours per year.

As result of the project activity will be displaced an amount of 50,466 tCO_2equ/year from the baseline scenario. The hydro power plant of *UHE Mascarenhas* has currently a power density[3] of 43 W/m^2 and as stated by the CDM EB[4] the GHG from the reservoir are neglected.

This type of project activity is not a Business as usual scenario (BAU) for the Brazilian generation and particularly at the project area. There are several reasons why increase the efficiency of the hydro power plant (either resizing or power upgrading) is not considered as economically attractive. The project attractiveness will depend upon the availability of the project developer to market the new energy, the financial situation of the company and the internal benchmark of the company on the required rate of return (RRR) on equity.

For the project activity, where the registration of the project activity may incentive similar the increase of the energy efficiency on the existing hydro power plants in Brazil where it is estimated that these projects could add to the grid up to 10% to 15% of the total energy generated by the Brazilian grid.

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

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

[3] *The current reservoir area is 4.194 km^2.*

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

The *UHE Mascarenhas* is placed at the north of the *Espírito Santo* state, an area with high voltage fluctuation, thus the project activity will contribute to avoid a waste of energy due to the reactive energy necessary to compensate such energy instability. Therefore the most important fact is that the project activity will avoid transmission of energy from other distant states into the project activity state[5]. Moreover, the project activity will have an important impact on the environmental sustainability by reducing local air pollution and decreasing the GHGs emissions that would otherwise been emitted under the baseline scenario and will contribute to sustainable development during the construction phase (by hiring local labour), during the operation phase (payment of taxes to the municipality), environmental programs (*Energest* is highly engaged on environmental education and to assist the local stakeholders on sustainable development plans).

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

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

A.3. Project participants:

Name of the Party involved	Private and/or public entity (ies) project participants	Kindly indicate if the Party involved whishes to be considered as project participant
Brazil (Host Country)	*ENERGEST S.A.*	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil.

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

Espírito Santo State. South East Brazil.

A.4.1.3. City/Town/Community etc:

Baixo Guandu.

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

The hydro power plant of *Mascarenhas* is located on the river *Rio Doce*, municipality of *Baixo Guandu*, state of the *Espírito Santo*. The Rio Doce river basin is placed at the South East of Brazil allocated throughout *Minas Gerais* and the *Espírito Santo* state, totaling 85,028 km^2. The physical coordinates are 40° 55’ 06’ W and 19° 30’ 02’ S. More details are provided in annex 5.

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

Renewable electricity generation for a grid (hydro power projects with existing reservoirs where the volume of the reservoir is not increased).

[5] *The Espirito Santo state presents an estimated energy deficit between 85%-90% of the energy consumed.*

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

The project activity is placed at the *UHE Mascarenhas,* a hydro power plant with a total head of 22 metres, being 17.6 meters the net head. Each Kaplan turbine is currently processing an average water flow between 230-275 m3/s. The project activity foresees the implementation of the 4th genset at the Mascarenhas power plant with an installed capacity of 55 MVA/24 MVrar, operating in a permanent operation mode. No changes on the mechanical, operation or control are foreseen within the project activity for the three gensets.

The generator will be have an operation/installed capacity of 49.5 MW with a 0.9 power factor. Under circumstances of normal operation, the genset will keep the voltage and frequency constant within a range of +/- 0.5 % of the output voltage value and +/- 5% for the frequency value. In order to keep the generator within the ranged values, an internal PID controller will be installed. The electric unit will be connected directly to the local sub-station (through an internal transformer, Δ connection) with an internal operation voltage of 14.49-13.11 kV. The technology for hydro power generation is well known and it has been widely applied in the Brazilian energy sector for the last decades.

The hydraulic turbine used is a Kaplan turbine from GE hydro, vertical shaft with adjustable blades for pitch in order to optimize the variation of the flow in. It is estimated that the group of generator + hydraulic turbine will have an overall efficiency of 92.12% (98% for the generator).

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

Year	**Annual estimation of emission reductions in tonnes of CO_2equ**
2007	37,850
2008	50,466
2009	50,466
2010	50,466
2011	50,466
2012	50,466
2013	50,466
2014	12,616
Total estimated reductions (tCO_2 equ.)	353,262
Total number of crediting years	*7*
Annual average over the crediting period of estimated reductions (tonnes of CO_2 equ.)	**50,466**

A.4.5. Public funding of the project activity:

No public financing for the 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 project activity:

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

The project activity has currently a power density of 43 W/m^2 and as stated by the CDM EB[6] can use the approved ACM0002 baseline methodology and the project emissions from the reservoir may be neglected.

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

This methodology is applicable to grid-connected renewable power generation project activities with electricity capacity additions such as hydro power projects with existing reservoirs where the volume of the reservoir is not increased. The project activity foresees the installation of the 4th genset to maximize the use of the reservoir with no modification on its level.

The project activity is grid-connected electricity generation from renewable energy sources. The consolidated baseline methodology ACM0002 for grid-connected electricity generation from renewable sources is therefore applicable to the project activity.

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

The Brazilian energy market is currently transforming into a wholesale electricity market with a layered dispatch model in order to promote competition. The dispatch model is managed by the ONS, the National Operator System based on the most economic dispatch order at any given time.

Moreover, the transmissions lines between geo-electric areas will definitely regulate the dispatch order by allocating first the energy within the geo-electric area where the energy was generated (the least costly option[7]) and then allocating the exceeding energy across others geo-electric areas or sub-markets; Northeast, North, South and Southeast/Central West. These electricity sub-markets must all be considered when defining grid operation and energy dispatch model on the grid operation margin.

For the purpose of determining the build margin (BM) and operating margin's (OM) emission factor, a (regional) project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints.

The project boundary defined for the project activity comprises the South/Southeast-Central West sub-system that represents the set of generators that are connected physically to the electricity system where the CDM project activity is connected to and could be dispatched without significant transmission constraints.

The table below provides the sources and gases included in the project boundary emitted by the project activity.

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[6] *From the EB 24 meeting held at10 – 1 May 2006, Annex 7 – Revision to approved consolidated methodology ACM0002*

[7] *The ONS must establish a least-cost planning to determine the mix of loads that would comprise a hypothetical least-cost resource portfolio designed to serve the expected load at the project boundary.*

	Gas	Source	Included?	Justification / Explanation
Baseline	CO_2	Emissions from the grid	Yes	The South/ South-East/ Central-East subsystem includes some thermal power plants that emit CO_2.
	CH_4	-	No	Not applicable
	N_20	-	No	Not applicable
Project Activity	CO_2	-	No	The power density of the project is higher than 10W/m2, therefore the project emissions are zero.
	CH_4	-	No	Not applicable
	N_20	-	No	Not applicable

Table 1. Gases included in the project boundary.

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

The baseline scenario is the consumption of electricity from the regional grid which includes non-renewable sources of energy.

For the project activity, regional grid definition is being applied as suggested by the ACM0002 consolidated methodology. The grid boundary definition comprises the South/South East/Central-West sub-system. Electricity transfers from external sub-systems (North and Northeast sub-systems) are considered electricity imports when the energy transfer occurs from the connected electricity system to the project electricity system and electricity transfers to connected electricity systems are defined as electricity exports.

The project activity will physically deliver energy within the project boundary that comprises the South/South East/ Central West sub-system. The baseline scenario presents a set of uncertainties related on how the CDM project will influence the operation and development of the interconnected electrical system over time. For this reason, it must be understood how the project will impact upon operations of the electrical grid and its impact upon capacity addictions.

The Brazilian electrical grid is currently based on a mix of energy power sources where the low cost and must run resources are working at the baseload and are represented by large hydro power plants. The baseload capacity is of 83.92 %[8] of the total installed power. The energy mix is balanced by intermediate operation mode power plants working with a typical capacity factor around 30% (combined cycle based on Natural gas, Nuclear and at some extend coal) representing the 8.7% of the total installed capacity. Finally, the power plants based on combustion turbines are working at the peak load and dispatched depending upon the forecasted demand. These power plants have low capacity factors and high operation marginal cost (Diesel Oil, Fuel Oil and black liquor and others).

In order to balance the type of energy generation and decrease the risk associated to the weather uncertainties, the Ministry of Mines and Energy (MME)[1] foresees for the period (2006-2023) an increasing share of thermal power plants on the energy matrix based on combined cycle (+297%), coal generation (+300%), Nuclear power generation (+150%) and a decrease on the share of large hydro power plants (-15%). The values are based on a scenario with a difference of 5% between the energy demand and the energy offer. Under a scenario[9] with increasing energy demand, the CDM project activity will affect likely impact on the size of the planned capacity additions or timing (deferral) of similar dispatch mode power plants. One way the CDM project would impact the future near-term capacity additions is based on the operating mode.

[8] *Brazilian installed capacity. Ministry of Mines and Energy (MME) at its Decennial expansion plan 2006-2015. MME 2006.*

[9] *The MME forecasts a yearly increase on the energy demand between 4% and 6% (Low and high consumption scenario).*

The timing of a project can also influence the appropriate weights to use for a combined margin calculation. The lead time for new electric capacity additions are relevant to the weighting of OM and BM on the way on what point in time the OM[10] value would switch to BM. In this sense, the table 02 shows a set of power plants forecasted by the MME at its decennial expansion plan.

Let's assume that the CDM project activity gets approval by the end of 2006, at that point the CDM project begins generating electricity (year one). Regarding the forecasted capacity additions for the period 2006-2010[11], the reference case shows new capacity additions on combustion turbines power plants, natural gas and coal power plants scheduled for the end of 2008 and 2010 with a lead construction time between 2 and 4 years (including any remaining design and permitting).

At the table below, there are two power plants identified that may be affected by the CDM project activity. For the diesel power plant *Goiânia II,* it would take two years (starting November 2006) to be constructed from the scratch, being finished on November 2008. The second power plant is the coal power plant *Carvão Ind.* starting construction in December 2006 and a lead construction time of 4 years (December 2010). Other power plants starting construction before 2007 (year one) are not likely affected by the CDM project activity since they have already secure the energy output in form of PPAs (power purchase agreements).

If the CDM project activity gets approval at the end of 2006 (year one), it's reasonable to think that construction of similar power plants (capacity factor, operation mode) are deferral by the CDM project activity. At the year one (year 2007) similar power plants (capacity factor, operation mode) starting construction and/or planning are deferred by the CDM project activity by displacing the starting operation data to November 2009 (*Goiânia II)* and December 2011 (*Carvão Ind.*).

Power plant name	Operation mode	Type of Generation	Installed capacity	Forecasted starting data	Lead time for construction[12]	Starting construction
Termorio	Intermed.	Natural Gas (CC)	670 MW	Already in place	3 years	March 2003
			123 MW	March 2006		
			370 MW	August 2006	3 years	August 2003
Santa Cruz	Peak	Diesel (CT)	166 MW	Already in place	3 years	February 2004
			316 MW	February 2007		
Três Lagoas	Intermed.	Natural Gas (CC)	240 MW	Already in place	3 years	January 2005
			110 MW	January 2008		
Canoas	Intermed.	Natural Gas (CC)	160 MW	Already in place	3 years	January 2005
			90 MW	January 2008		
Cubatão	Intermed.	Natural Gas (CC)	216 MW	July 2008	3 years	July 2005
Goiânia II	Peak	Diesel (CT)	140 MW	November 2008	2 years	Nov. 2006
Araucária	Intermed.	Natural Gas (CC)	469 MW	December 2008	3 years	Dec.2005
Jacui	Intermed.	Coal	350 MW	December 2008	4 years	Dec. 2004
Candiota III	Intermed.	Coal	350 MW	December 2009	4 years	Dec. 2005
Carvão Ind.	Intermed.	Coal	350 MW	December 2010	4 years	Dec. 2006

Table 02. Lead time for construction and operation of new capacity additions, forecasted by the MME, 2006.

[10] *OM is here understood as operation margins and BM the build margins.*
[11] *The new capacity additions forecasted are based on the MME decennial expansion plan.*
[12] *Based on the OECD/IEA report: Projected Cost of Generating Electricity, 2005.*

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

This chapter is constructed based on the third version of the document: "Tool for the demonstration and assessment of addicionality" as defined from the Sixteenth Meeting of the Executive Board.

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

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

Definition of possible/potential alternatives to the project activity:

1. - Implementation of the project without CDM assistance.

In the year 2003, the Brazilian energy regulatory market considered *Energest* as a public service company where the generation activities from the facility where considered as a public service. For such type of activities, the ANEEL (National electricity agency) defined that any new generation unit from *Energest* will be granted not by the generated energy but a previously defined WACC (Weighted Average Cost of Capital).The calculation of the WACC established by the ANEEL for such generation actives is calculated based on the O&M cost of the all generation activities, depreciation of the generation assets and remuneration based on the fixed assets.

Basically for the case of the 4th genset of *UHE Mascarenhas,* the remuneration was based on the capital return (through depreciation), return on the investment capital (rentability), return on the O&M cost plus sectorial taxes (wheeling fees, connexion cost, etc). Such way of remuneration was defined for the existing generation assets such as the *UHE Mascarenhas,* in opposite to the new generation assets (known as independent energy producers) that may get a return on the investment capital through the KWh generated and established on a public bid with a maximal price based on the nominal value (VN).

Based on the fixed assets, the remuneration from an extra generation unit is not an attractive investment scenario for new investments, and in the case of the 4th genset of *UHE Mascarenhas* it was not different. Moreover, technical studies carried out at the hydropower dam shown increasing risk on structural damages at the hydro power dam associated to an eventual resizing project and therefore increase the amount of necessary investment.

2.-Do not implement any project activity. (Continuation of the current situation, where no project activity or alternatives are undertaken).

Since the time of the internal proposal of the referred project activity, the project developer had the credible and realistic alternative to do not implement the renewable energy generation, instead of that, it is considered the alternative to continue with the baseline scenario, characterized by the tendency of relevant increase of thermal energy share. This alternative is in compliance with all applicable legal and regulatory requirements.

According to the Energy Expansion Plan of 2006 to 2015 (Ministry of Energy), the grid tends to decrease its dependence on hydropower sources such as Small Hydro Power. Nowadays, around 84% of the national grid is related to hydro generators, and the Brazilian government foresees a scenario of 70% from this source up to 2023, what represents a decrease of 14% from 2006 to 2023. It is expected that thermal based generation (natural gas and coal) will have an expressive share of generation.

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

The alternatives identified are all in compliance with all applicable legal and regulatory requirements.

Step 2. Investment analysis.

The CDM project generates financial or economic benefits other than CDM related income, and then the benchmark analysis (Option III) is applied.

Sub-step 2a – Determine appropriate analysis method.

The benchmark analysis was chosen since the CDM project activity generates economic benefits other than CDM related income.

Sub-step 2b – Option III. Apply benchmark analysis.

The most appropriate financial indicator for this project type is the Internal Rate of Return (IRR) since it is the more straightforward and understandable method in capital budgeting. The selected benchmark is the company internal benchmark or WACC defined for the company, an average representing the expected return on all of a company's securities. The company benchmark is the tool that project developer uses to assess the potential for new generation projects and has been consistently used in the past. The benchmark used by Energest at the time being is set on 15% (year 2006) and 14.72% at the year 2003, when the decision to go on with the project activity was taken.

The benchmark here used (weighted average capital cost of the company) for the project activity represents a value extensively used by *Energest* to represent the minimum standard internal return, which is composed mainly by the RRR (required rate of return) for the investors plus a country risk linked to the cost of capital.

WACC is calculated by multiplying the cost of each capital component by its proportional weight and then summing:

$$WACC = \frac{E}{V} * Re + \frac{D}{V} * Rd * (1 - Tc)$$

Where:
Re = cost of equity
Rd = cost of debt
E = market value of the firm's equity
D = market value of the firm's debt
V = E + D
E/V = percentage of financing that is equity
D/V = percentage of financing that is debt
Tc = corporate tax rate

Alternately and in addition to the company internal benchmark it could also be used as a benchmark the project IRR from a similar financial option as the investment for the project activity found at the Brazilian financial market which are the government bond rates. The Brazilian financial market is for all accounts one of the most liquid and sophisticated among emerging markets, offering a wide range of debt instruments (fixed-rate, floating-rate and inflation linked bonds). Federal bonds come with fixed nominal rates (LTN and NTN-F) and floating-rates (LFT), as well as with principal linked to the price index (NTN-C linked to the IGP-M).

The selected benchmark for the project activity are the NTN-C, National Treasury Notes – C series bonds which yields are linked to variation of the General Price Index - IGP-M (estimated in 2006 of

4.2%), along with the interest defined upon purchase (9.03 % at present time[13]). Moreover, a foreigner investor will consider an increase in the expected return due to the country risk (today estimated around 2.5%-3%[14]). This type of treasury notes has a fixed payment every six months (in the form of interest) for a life span of 20 years, ideal for medium a long term investments.

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

For the project activity the IRR is calculated, with & without the CDM related income, based on the available data for the year 2003, the investment scenario, the energy prices and the expected return on the year 2003.

Unit	IRR Value
IRR for the *UHE Mascarenhas* power upgrading project without CDM.	11.52 %
IRR for the *UHE Mascarenhas* power upgrading project with CDM[15]	13.01 %
Differential (with & without CDM)	1.49 %
Company Internal Benchmark (WACC)	14.72 %
Benchmark (NTN-C, National Treasury Notes @ 2003 [16])	10 % + 8.42[17]% = 18.42 %

Table 3. IRR variation with/without the CDM related income. (Source: Single parameters were provided by the project developer).

The project financial cash flow is defined as follows in the table below. The lead time for the project activity implementation is of three years (started operation scheduled for July 2006).

13 *http://www.tesouro.fazenda.gov.br/tesouro_direto/download/rentabilidade.pdf*
14 *EMBI Brazil +, JP Morgan index.*
15 *Initial USD/tCO2equ: 8 Euros.*
16 *http://www.tesouro.fazenda.gov.br/tesouro_direto/estatisticas/historico.asp*
17 *IGP-M for the year 2003.*

MASCARENHAS HYDRO POWER PLANT

ENERGY CHARACTERISTICS	
Installed Capacity (MW)	49.5
Energy (MW avarage)	22.9
Availability factor	100.00%
Minimum Value	65.00%
Maximum Value	100.00%
Maximum generation (in MWh/year)- Firm	200,604

ENERGY COST	
Rate for sales (mix of energy purchasing prices)	21.17
Rate for sales(after initial contracts)	21.17

PURCHASE OF THE ENERGY TRANSPORTATION	
Tariff for transportation	0.51
Rate for distribution	0.00
Conection fee	0.51

ECONOMIC LIFE OF THE PLANT	
Life time (years)	28

INVESTMENT DESCRIPTION (US$)	
Investment in Hydro Power Plant	**19,544**
Administration staff	651
EPC	18,848
Others	0
Facilities	0
Enviroment	44
Fluctuation value from the initial investment	**1.51**
Unitary cost (in US$/installed kW)	
Minimum value - all in cost	380.77
EPC (calculated)	18,848

INTEREST DURING CONSTRUCTION	
Own capital (Minimum value)	10.00%
Third Market Capital (Maximum value)	0.00%

AMORTIZATION	
Method	Constant
Period (years)	6
Grace period (years)	3

LEGAL CHARGES	
ICMS	
- ICMS on eletric energy	**25.00%**
Taxes on invoiced revenues	**3.65%**
- PIS (in %)	0.65%
- COFINS (in %)	3.00%
CPMF (in %)	**0.38%**
Taxes on revenues	**33.00%**
- Income tax (in %)+D40	25.00%
- Social Contribution without revenues (in %)	8.00%
Finantial compensation =%*Cap*RCD (in US$)	**194,952**
- Reference Currently Duty - RCD (in US$)	14.40
- Applied Percentual	6.8%
ANEEL inspection taxes = 0.50% of revenues	**0.5%**

OPERATIONAL COSTS	
O&M costs (in US$/MWh)	
- Fixed costs (US$)	48,860
- Variable costs (US$/MWh)	0.00
	0.00
Security costs - Technic/Operational (in US$/ MWh)	0.00

FINANCIALS ENCHARGES	
Financial tax (%/y)	8.74%
Working Capital (%/y)	0.00%
Taxas de aplicações financeiras (em % ao ano)	0.00%
Dollar Tax	3.07

SHAREHOLDERS POSITION	
Dividend Payment (%)	95.00%
Leverage (%)	0.00%

MINIMUM ATTRACTIVE TAX	
Minimum attractive tax	12.00%
Taxa de Reajuste Anual Esperada (Invest. Inicial)	6.00%

DEPRECIATION	
Equipments	3.68%
Civil Works	0.00%
Engineering and Pre-operational	0.00%
Annual Depreciation (average)	3.68%

CARBON CREDITS	
tonnes equ CO2 (Year)	63,000
CER`s Value (Euro)	18.00
Excepted Revenue (US$ thousand/year)	0

YEAR 01	**42.89%**
Civil work	19.47%
Facilities, appurtenances	18.13%
Environment	3.76%
Administration staff	0.00%
Engineering/ Management (EPC)	0.10%
Worksite	1.43%
Substation/Transmission line	0.00%
Eventual	0.00%
Eventual (2)	0.00%
Eventual (Ensaio Modelo Reduzido)	0.00%
YEAR 02	**49.23%**
Electromechanic equipment	22.35%
Hydromechanic equipment	20.81%
Civil work	4.32%
Facilities, appurtenances	0.00%
Environment	0.11%
Administration staff	1.64%
Engineering/ Management (EPC)	0.00%
Worksite	0.00%
Substation/Transmission line	0.00%
Eventual	0.00%
YEAR 03	**7.88%**
Electromechanic equipment	3.58%
Hydromechanic equipment	3.33%
Civil work	0.69%
Facilities, appurtenances	0.00%
Environment	0.02%
Administration staff	0.26%
Engineering/ Management (EPC)	0.00%
Worksite	0.00%
Substation/Transmission line	0.00%
Eventual	0.00%

FIRST YEAR OF OPERATION	
Number of months of generation	6

Table 4.Financial premises for the project activity.

The following assumptions were taken in consideration for the analysis:

- An annual average of IGPM based on 5% (2005).
- The expected energy output is of 200.6 GWh per year. The installed power is estimated on 49.5 MW and 22.9 MWaverage.
- EPC and environmental programs (if any).
- Generation fee granted by ANEEL on 65 R$/MWh in August 2003.
- Financial cost, depreciation and amortization.
- Construction, O&M costs, wheeling fees (*CUST*) and grid connection fees.
- CDM consulting fees and transaction cost. The CERs issuance fee as well as the validation and the annual verification fees have not been included in the cost presented at the cash flow.
- The generated energy will offset the *Energest* energy demand and sectorial taxes (12.812 %).

Sub-step 2d. Sensitivity analysis.

During the investment scenario at the time of the decision (December 2003) the energy market was flooded on regulation uncertainties; not just on the energy tariff but the macroeconomic scenario that would might eventually impact the whole project. Therefore, there are three variables here analyzed for the sensitivity scenario to check the robustness of the conclusion given at the sub-step 2b: the energy tariff, the investment cost and the CERs revenue. The O&M cost are totally internalized and therefore likely under control.

• Energy tariff (Δ +/- 25%):

Company Internal Benchmark (WACC)	**14.72 %**
Energy tariff – Base case: 65 R$ (USD 20.83)[18]	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	11.52 %
Energy tariff : 55 R$ (USD 17.63)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	9.74 %
Energy tariff – Base case: 60 R$ (USD 20.83)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	10.64 %
Energy tariff : 70 R$ (USD 17.63)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	12.37 %
Energy tariff : 75 R$ (USD 17.63)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	13.20 %

Table 5. Sensitivity analysis for the variation of the energy tariff. (Source: Single parameters were provided by the project developer).

- Investment cost (Δ +/- 20%):

The variation on the investment cost follows a realistic approach regarding the project activity cost. A positive variation on the investment cost (increase) will reflect a set of uncertainties (macroeconomic, technical risk involving the dam through structural damages, etc). Therefore a scenario where the cost decreases will likely not to happen, however for comparison purposes is also analyzed.

Company Internal Benchmark (WACC)	**14.72 %**
Investment - 5% : 57.1 MR$ (18.3 M USD)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	12.01 %
Investment - 10 % : 54.2 MR$ (17.37 M USD)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	12.55 %
Investment - 15 %: 51.3 MR$ (16.44 M USD)	**IRR Value**

[18] *USD 1 = R$ 3.07 in 2003.*

IRR for the *UHE Mascarenhas* power upgrading project	13.14 %
Investment – Base case: 60 MR$ (20.83 M USD)[19]	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	11.52 %
Investment +5 %: 62.9 MR$ (20.16 M USD)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	11.06 %
Investment +10 %: 65.8 MR$ (21.08 M USD)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	10.64 %
Investment +15%: 68.7 MR$ (22 M USD)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	10.25 %
Investment +20 %: 71.6 MR$ (22.9 M USD)	**IRR Value**
IRR for the *UHE Mascarenhas* power upgrading project	9.89 %

Table 6. Variation on the investment cost. (Source: Single parameters were provided by the project developer).

- CERs related income variation:

CERs related income variation		**IRR Value**
Base case		11.52 %
IRR value with CDM	8 USD/tCO2equ.	13.01 %
IRR value with CDM	10 USD/tCO2equ.	13.39 %
IRR value with CDM	12 USD/tCO2equ.	13.78 %
IRR value with CDM	15 USD/tCO2equ.	14.37 %
IRR value with CDM	18 USD/tCO2equ.	14.96 %

Table 7 .Variation on the price for CERs . (Source: Single parameters were provided by the project developer).

By analyzing the comparative tables above, under any project scenario the value of the IRR is always lower than the WACC, the internal benchmark applied by the company. Therefore regardless how the market may increase the energy tariff (market performance) and how affect on the deviation of the initial investment (likely not to decrease), the project activity is unlikely to be the most financially attractive option as stated in the sensitivity analysis and therefore additional.

Step 3. Barrier analysis

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity:

The following barriers were here considered:

(a) Investment barrier and uncertainties on the energy regulatory frame in the period 2000 to July 2005.
(b) Macro economic uncertainties.
(c) Risk on the energy prices.

(a) Investment Barrier and energy market regulatory uncertainties (From 2000 to July 2005).

From the energy scenario in 1990's, where the state owned facilities defined the investments on new generation units, up to July 2005, where the Brazilian market was designed as a wholesale electricity market with a layered dispatch model and separation between activities (energy generation, distribution and commercialization), the Brazilian energy sector was flooded with a set of regulatory uncertainties, power shortage and macroeconomic instability that definitively paved the way for new opportunities in the energy distribution and the energy market.

The new regulations were based on the following basis:

[19] *USD 1 = R$ 3.07in 2003.*

- Total separation on the activities of generation, transmission and distribution.
- Fee for service approach for the transmission lines access and connection to the energy grid.
- The distribution companies will have to contract 100% of their expected electricity demand over a period of 3 to 5 years; the contracts will be coordinated through a "Pool" with maximum tariff price established by the ANEEL. 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. These measures should reduce market volatility and will allow distribution companies to better estimate market size.
- The generation utilities will be dispatched according to the least cost options available at each sub-market being managed by a regional office, comprising four operational and dispatch offices for the different geo-electric areas: Northeast, North, South and South East/Central West.

Within the new energy sector regulation, the generation facilities were separated between independent producer and as a public concession producer. The category of independent producer was granted based exclusively on the MWh generated and the public concession producer could not be granted by MWh but just to offset the captive generation of the company.

As a result between 2001 and 2003 no new investments on generation units were undertaken since they were not as attractive as the distribution project activities. Moreover, as stated before, the regulatory framework encouraged investments on generation projects based on new power plants and therefore to generate energy under as an independent producer model.

As shown before the project activity had to overcome barriers when comparing with other investment activities competing for the investment resources.

(b) <u>Macro economic uncertainties.</u>

The Brazilian economy went through an energy crisis in 2001 and 2002. In August 2002, an internal economic crisis forced the Government to seek a renewal of its stand-by agreement with the International Monetary Fund. As the currency, debt bonds and equities collapsed, $30 billion was made available through to the end of 2003 subject to quarterly performance reviews. Brazilian assets though didn't bottom until October 2002 when the Real (R$) had lost well over 50% of its value against the Dollar. Moreover and as a consequence of the long period of inflation during the 90's, the Brazilian currency experienced a strong devaluation, effectively precluding commercial banks from providing any long-term debt operation. These uncertainties affected negatively the upgrading of the power plant planning, since this scenario could repeat.

These barriers were presented to the project developer as a consequence of the lack of a long-term debt market and the high risk evolving the economy, the project developers were unable either to reach the WACC required by investors or to identify sources of financing with equitable interest rates to decrease the cost of capital and to make project activities more attractive.

(c) Risk on the energy prices.

Under a likely power shortage on the early 2000, the federal government launched in the beginning of the year of 2000 the Thermoelectric Priority Plan[20] originally planned 17,500 MW (47 thermo plants) of new thermal capacity by December of 2003. During 2001 and the beginning of 2002 the installed power was reduced to 13,637 MW (40 thermo plants)[21].

Under the power shortage scenario, the Brazilian government increased drastically the share of the thermal capacity[22]. Based on this concept, the Brazilian government defined a set of back up thermal units in order to cover the immediate peak energy demand to ensure a low risk operation profile for each energy sub-system. One of the most important issues of the thermal plan is that the distribution company has a *take-or-pay* contract with the thermal generation company.

Nowadays, since large reserves of natural gas have been discovered at the *Santos* basin[23], the Ministry of Mines and Energy (MME)[24] foresees an increasing share of thermal power plants on the energy matrix[25] based on combined cycle[26] (+297%)..

Rationing was lifted at end-February 2002. As consequence of this, the industry reduced the waste of energy by replacing gensets and appliances by more cost-efficient substitutes. By 2003, electricity consumption had still not reached the level prior to the rationing programme. This persistent reduction in demand, coupled with the increase in installed capacity after 2001, created excess supply in the market, adversely affecting generators and some specific distribution companies.

Under such scenario, the project developer additionally had a set of uncertainties regarding the energy market and the energy tariff; if the reservoirs were on a high level and the development rate of Brazil were low, energy tariff would drop down.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives:

As previously described, the main alternative is the continuation of the current situation, where no project activity or alternatives are undertaken. Under such scenario the project developer would have invested the capital on the distribution facility or other investment opportunities abroad.

Step 4. Common practice analysis.

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

There are other power generation plants, which were identified in the proposed project activity's region/state operating under similar characteristics (similar age, installed power, power density and technology) and taking place under similar market conditions (here understood as the regional grid).

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[20] *Federal Decree 3,371 of February 24th, 2000, and Ministry of Mines and Energy Directive 43 of February 25th, 2000.*

[21] *Federal Law 10,438 of April 26th, 2002, Article 29.*

[22] *Emergency Energy Program based on a total of 2,150 MW (58 small to medium thermal power plants) until by end of 2002 (using mainly diesel oil, 76,9 %, and residual fuel oil, 21.1 %).*

[23] *The MME foresees the implementation of a gas pipeline from the South to the Northeast to be finished at the end of 2006. The GASENE gas pipeline will deliver more than 20 Millions Nm^3 of natural gas per day.*

[24] *Brazilian installed capacity. Ministry of Mines and Energy (MME) at its Decennial expansion plan 2006-2015. MME 2006.*

[25] *Clearly, new additions to Brazil's electricity power sector are shifting from hydro to natural gas plants (Schaeffer et al., 2000).*

However, none of these power generation plants were able to carry on activities such as the proposed project activity.[27] without the income from the CDM.

Under such scenario, potential projects similar to the proposed project activity observed are described bellow:

- *UHE Suíça* large hydro power plant.
- *Rio Bonito* small hydro power plant.
- *Aparecida* small hydro power plant.

1.-UHE Suíça large hydro power plant.

The power plant is placed at the *Espírito Santo* state; currently operating and accessing to the same power grid as the project activity, within the same project boundary. The power plant has an installed power of 30.06 MW and started operation in the year 1965.

The power plant may improve both the efficiency and increase the installed power of the power plants, however, up to date there are no economic means to improve the efficiency of the power generators. The reason for this is that halting the power plant will lead to higher economic losses than improving the generator efficiency. Under the current energy regulatory market, the power plant is considered as an autonomous power producer, the MWh of energy generated will be sold in the energy pool with a maximum price for the generated energy which is defined by the ANEEL. The nominal value considered by the ANEEL for former public concessions, the case of *UHE Suíça*, calculates the energy tariff based on the generation cost minus the depreciation cost that ANEEL considered as already abated for old utilities.

As consequence of this, the investment on resizing and/or power upgrading project on the *UHE Suíça* is not at all attractive.

2.-Rio Bonito small hydro power plant.

The power plant is placed at the *Espírito Santo* state; currently operating and accessing to the same power grid as the project activity, within the same project boundary. The power plant has an installed power of 16.8 MW and started operation in the year 1959. Several technical actions may be taken to upgrade and improve the efficiency of the power plant, such as replace generation units, increase the Kaplan turbines efficiency (blades, automatic pitch control) and to increase the efficiency on the electrical installations (transformers, transmission lines, etc).

Again, the Brazilian energy regulations considered the power plant operating under a public concession regime, so the energy generation is granted by a nominal value lower than for new generation utilities. Under such scenario, the same as the project activity, there are no economic means to improve the efficiency of the power plant so the project is not economically feasible.

3.- Aparecida small hydro power plant.

The power plant is also placed at the *Espírito Santo* state and has an installed power of 480 KW; the small hydro scheme started operations on the year 1919 and was deactivated in 1993 since the operation of the power plant had no economical sense.

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

[27] *The only similar project that is being conducted is also considering the CDM revenue. The registered project is "Repowering Small Hydro Plants in the State of Sao Paulo, Brazil. CPLF Energia, July 2005"*

For the generation company, the decision to power upgrade a generation unit is always competing in resources with the investment of the capital anywhere else, even with the investment on new generation sources. The energy market is totally cost oriented and therefore many projects far from the consumption centers (high transmission losses and transmission fees), small scale and with low financial return will not be attractive for investors.

Conservatively speaking its estimated that only in Brazil there are around 1,500 small hydro units (SHP) in unknown situation or deactivated, mainly off-grid and placed on rural areas. Since the 70's the Brazilian government promoted large hydro power plants in order to optimise the investment cost, leaving aside small hydro power schemes mainly located in remote areas, far from the consumption centres where the investment on transmission capacity and O&M costs where too high[28].

The improvements that may be undertaken at the power plant consider the replacement of the electro-technical and hydro-mechanical equipments and the installation of control protection and auxiliary equipment, where the technology is well known and may be manufacture in Brazil. The IRR of the power plant is of 13.93%, however the higher IRR value than the project activity IRR, the power plant is deactivated since it does not present attractiveness for investors and it is more attractive to invest on new generation facilities.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline

For the baseline determination, project participants shall only account CO2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity. Therefore, the **annual baseline emissions (BE_y)** use the Combined Margin (CM) approach to calculate the baseline scenario emissions. The annual baseline emissions (BE_y) is the result of the annual net electricity generated from the Project (EG_y) times the yearly baseline emission factor (EF_y).

$$BE_y = EG_y * EF_y \quad \textit{Equation 1}$$

EG_y *(MWh/year)* = The generation of the project activity.

EF_y*(tCO_2MWh)*= Weighted average emissions per electricity unit within the electrical system.

From ACM0002 baseline methodology establishes the baseline emission factor (EF_y) is based on the combined margin (*CM*) approach, 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.

[28] *Large hydro 88% of the installed power vs. 1% of the installed power for small hydro schemes. Source: decennial expansion plan, Ministry of Mines and Energy.*

Dispatch data analysis should be the first methodological choice. Where this option is not selected project participants shall justify why and may use the simple OM, the simple adjusted OM or the average emission rate method taking into account the provisions outlined hereafter.

For the project activity the simple adjusted OM method is used for the calculations. 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*):

$$EF_{OM,\ Simple\ Adjusted,\ y} = (1-\lambda_y)\cdot\frac{\sum_{i,j} F_{i,j,y}\cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y\cdot\frac{\sum_{i,k} F_{i,k,y}\cdot COEF_{i.k}}{\sum_k GEN_{k,y}} \qquad \textbf{\textit{Equation 2}}$$

Where:

- λ_y is the share of hours in year *y,* for which low-cost/must-run sources are on the margin.
- $\sum_{i,j} F_{i,j,y}$ is the amount of fuel *i* (mass or volume unit) consumed by relevant power sources *j*
- $COEF_{i,j}$ 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); and
- $\sum_j GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j* (analogous for sources *k*).

For the project activity, the low operating cost and must run resources typically include large hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. Therefore the emission factor for low-cost/must-run resources can reasonably be: $EF\ OM_{,y} = 0$.

The non-low-cost/must run sources for the project activity are thermal power plants burning coal, fuel oil, natural gas and diesel oil.

The most recent numbers for the interconnected S-SE-CO system were obtained from the Brazilian national dispatch center (ONS) in the form of daily consolidated reports. The load duration curves and energy demand for the project boundary of the project activity are given in Annex III.

In order to calculate the Operating Margin (OM) emission factor, the project boundary has to be modelled with electricity imports from other geo-electric systems to describe, as close as possible, the baseline situation. The ideal approach is to determine the impact of electricity imports on the "merit order" operation margin. This approach is true when dispatch merit of the external grid power sources are clearly known based on reliable data[29], if not the average emission rate of the exporting grid will be used otherwise.

For the project activity, the electricity imports from the North sub-system are based on hydro power generation operating at the system baseload. The previous means that the implementation of the project activity will not have any displacement effect on the energy provided by this low-cost/ must-run source that will anyway operate at the baseload.

[29] *The grid operator (ONS) must provide enough data to identify such marginal plant(s).*

On the other hand, the imports from the Northeast subsystem are composed by a mix of generation (thermal combined cycle, thermal combustion turbine and hydro power) with a dispatch model based on bilateral contracts and/or energy bids.

The methodology for the emissions factor calculation is based on the *Simple Adjusted OM*. In order to define plot the Load Duration Curve, data were sourced from the ONS for the years 2003, 2004 and 2005. In order to separate low-cost/must-run power sources and other power sources, the ANEEL[30] (National electricity agency) database was consulted (see annex 3 for more information).

- **STEP 2.** Calculate the Build Margin emission factor ($EFBM_{,y}$) as the generation-weighted average emission factor (tCO2/MWh) of a sample of power plants *m*.

For the purpose of determining the Build Margin (BM) emission factor, the spatial extent is limited to the project boundary since recent or likely future additions to the transmission capacity are not meaningful regarding the amount of imported electricity vs. generated energy at the project electricity system.

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. Power plant capacity additions registered as CDM project activities should be excluded from the sample group *m*.

$$EF\_BM_y = \frac{\sum_{i,m} F_{i,m,y} . COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$ ***Equation 3***

- **STEP 3.** The **baseline emission factor (EF_y)** is a weighted average of the EF_OM_y (operating margin carbon emissions factor) and the EF_BM_y (build margin carbon emissions factor).

$$EF_y = (\omega_{BM} * EF\_BM_y) + (\omega_{OM} * EF\_OM_y)$$ ***Equation 4***

Where:

$\omega_{OM} = \omega_{BM} = 0.5$ *as defined at the baseline methodology ACM0002.*

The baseline emissions (BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh), as follows:

$$BE_y = EG_y * EF_y$$ ***Equation 5***

Leakage

The leakage and the emissions from the project activity are equal to zero. The main emissions giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation. No sources of leakage were identified for the project activity.

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30 *Available in:* www.aneel.gov.br

Project Emissions

The EB 23 report at its Annex 5, page 1, establishes the threshold and criteria for the eligibility of hydropower plants with reservoirs as CDM project activity. The current installed capacity for the Mascarenhas power plant is of 180.5 MW where the flooded area is equal to 4.19 km^2. The previous figures give a current power density of 43 W/m^2, which means that the project emissions (*PEy*) from the reservoir may be neglected.

Emission Reductions

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reduction ER_y by the project activity during a given year y will be calculated *ex-ante* and will be provided by the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y - Ly \quad \textit{Equation 6}$$

For the project activity, $PE_y = Ly = 0$.

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

Data / Parameter:	**EF**
Data unit:	tCO_2equ/MWh
Description:	CO_2 emission factor for the grid
Source of data used:	Data obtained from ONS (National Operator System) and calculated according to methodology ACM0002 (version 06). The emissions factors of Revised IPCC Guidelines for National Greenhouse Gas Inventories were used.
Value applied:	0.262
Justification of the choice of data or description of measurement methods and procedures actually applied :	The baseline emission factor (EF_y) is calculated as the weighted average of the combination of operating margin (*OM*) and build margin (*BM*) factors. It will be calculated *ex-ante.*

Data / Parameter:	**EF_OM_y**
Data unit:	tCO_2equ/MWh
Description:	CO_2 Operating Margin emission factor for South East/ Central West and South system
Source of data used:	• Data obtained from ONS (National Operator System) and calculated according to methodology ACM0002 (version 06). The emissions factors and oxidation factor were obtained from Revised IPCC Guidelines for National Greenhouse Gas inventories. The net calorific value (energy content) were obtained from the country specific values.
Value applied:	0.413 (Average of the years 2003, 2004 and 2005)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002. It will be calculated *ex-ante*.

Data / Parameter:	**EF_BM_y**
Data unit:	tCO_2equ/MWh
Description:	CO_2 Build Margin emission factor for South East/ Central West and South system
Source of data used:	Data obtained from ONS (National Operator System), SIESE and ANEEL. It calculated according to methodology ACM0002 (version 06). The emissions factors and oxidation factor were obtained from Revised IPCC Guidelines for National Greenhouse Gas inventories. The net calorific value (energy content) obtained from the country specific values.
Value applied:	0.11
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002. EF_BMy was calculated *ex-ante* for a sample group *m* consists of the five power plants that have been built most recently and actually on operation

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

Data / Parameter:	**$COEF_i$**
Data unit:	tCO_2 /mass
Description:	CO_2 emission coefficient of each fuel type i
Source of data used:	Revised IPCC Guidelines for National Greenhouse gas Inventories 1996

Value applied:	Variable
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

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

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

Data / Parameter:	**Plant name**
Data unit:	Text
Description:	Identification of power source/ plant for the BM
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Please see table 9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002. Comprise the five most recently built plants, which comprise the larger annual generation compared to the recently built 20%.

Data / Parameter:	**λ_y**
Data unit:	Dimensionless Number
Description:	Fraction of time during which low-cost/ must-run sources are on the margin
Source of data used:	Calculated according to data provided by ONS
Value applied:	$\lambda_{2003}= 0.530$, $\lambda_{2004}=0.504$, $\lambda_{2005}=0.513$

Justification of the choice of data or description of measurement methods and procedures actually applied :	Factor accounting for number of hours per year during which low-cost/must-run sources are on the margin. $$\lambda_y = \frac{hours\ per\ year\ for\ which\ low-cost \backslash must-run\ sources\ are\ on\ margin}{8760\ hours\ per\ year}$$

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

B.6.3 Ex-ante calculation of emission reductions:

The operating margin for the project boundary is calculated *ex- ante* using the full generation-weighted average for the most recent 3 years. The amount of fuel consumption for thermal generation for the project boundary is available for 2003, 2004 and 2005 (last year availability of the data). The average *EF_OMy* for the project activity is 0.413 (kg CO_2equ/kWh). At the table 8 below the values are given.

Data Vintage	EF_Omy (kg CO_2equ/kWh)
2003	0.41
2004	0.38
2005	0.45

Table 8. Values of EF_OMy

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

As noted by *Kartha et al.*,[31] even in well-planned electricity systems, it is not easy to determine the timing and type of new electricity capacity additions. For the project activity the most recent data based on historical capacity additions are provided through the NOS.

The values for energy generation are defined through the wholesale electricity market operator (CCEE) and where data are not available, default values for the Brazilian grid system are defined[32].

The build margin is estimated *ex-ante,* based on the five most recently built plants, which comprise the larger annual generation compared to the recently built 20%, thus they represent the capacity additions to the system. The list of the power plants is given below (Table 9):

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

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

Power Plant	Installed Capacity (MW)	Assured Energy (MWmed)	Annual Generated Energy (MWh)	Fuel	Operation
Santa Clara	120.168	69.6	609,696	Jordão River	31/07/2005
Barra Grande	465.5	380.6	3,334,056	Pelotas River	nov/05
Aimorés	330	172	1,506,720	Doce River	30/07/2005 22/12/2005(L.O)
Ourinhos	44	23.7	207,612	Paranapanema River	12/7/2005
TermoRio	793.05		5,210	Natural Gas	mar/06

Table 9. Power plants on the Build Margin. Data Source: NOS (Brazilian grid operator entity) and ANEEL.

Using equation 4, EF_BM_y for the selected plants is 0.11.

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

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

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

Year	Estimation of project activity emissions	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of overall emision reductions
2007	0	37,850	0	37,850
2008	0	50,466	0	50,466
2009	0	50,466	0	50,466
2010	0	50,466	0	50,466
2011	0	50,466	0	50,466
2012	0	50,466	0	50,466
2013	0	50,466	0	50,466
2014	0	12,616	0	12,616

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	KWh
Description:	Electricity Generation delivered to grid
Source of data to be used:	Measured by project developer and monitored by the ONS.
Value of data applied	192,720,000 kWh

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	It will be recorded hourly and archived in electronic and paper format.
QA/QC procedures to be applied:	Data will be monitored and registered by the project developer. Sales invoices will ensure consistency for the collected data.

B.7.2 Description of the monitoring plan:

The Monitoring plan is based on the approved monitoring methodology ACM0002, "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources". The monitoring methodology applies to grid-connected renewable power generation project activities such as electricity capacity additions from existing hydro power projects with existing reservoirs where the volume of the reservoir is not increased.

1. Monitoring Process

The monitoring plan provides a set of procedures for continuous monitoring of the electricity generation of the project activity that is exported to the grid and measured by means of a kWh-meter. The monitoring methodology schedules a continuous screening of the defined values and the further storage on electronic format. (Excel spreadsheet).

The monitoring of the 4th genset will be based on an internal control and sampling unit that will execute the operation routines, pre-synchronization and final synchronization of the genset with the electrical grid. An internal mechanical device will be responsible to switch off the genset from the electrical grid. The process and data will be directly monitored at the specially built interface human-machine.

The operational structure will be based on a continuous monitoring of the *Net energy generation* delivered to the grid. The further collection, data analysis and records' handling will be managed by the power plant operation staff and the records will be kept on electronic format. The project developer will be responsible for developing the forms, registration formats for data collection and further classification.

The technical team will supervise the project activity based on monitoring spreadsheets, checking those parameters that are necessary in order to calculate the necessary data contained on the referred methodology. Furthermore the quality assessment procedures or/and any further technical auditory will be carried out at the project premises by the verification company.

The maintenance structure will be based on the internal O&M (Operation and Maintenance) staff to guarantee the perfect operation of the electricity meters. The maintenance structure will also ensure that the monitoring equipment is perfectly equilibrated based on the ANEEL, INMETRO[33], or the equipment manufacturer standards.

The project developer is the only responsible for the operation, direct monitoring and data registration. Also the project developer will ensure enough human and material resources for the accomplishment of the activities within the monitoring plan.

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[33] *Brazilian institute for metrology and calibration*

2. Emissions reduction calculation process

The main data needed to recalculate the operating margin emission factor are based on the *simple adjusted OM* from the approved baseline methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

The main data needed to recalculate the build margin emission factor are also consistent with the approved baseline methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".

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

The baseline study for the project activity and monitoring methodology were completed on 5/06/2006 by *Ecologica Assessoria*, which is not a project participant. Below, the name of person and entity determining the baseline:

Name of person/Organization	Project Participant
Alejandro Bango Ecologica Assessoria Ltda. São Paulo, Brazil. Tel: +55 11 5083 3252 Fax: +55 11 5083 8442 e-mail: alejandro@ecologica.ws WWW: www.ecologica.ws	NO

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:

30/01/2006.

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

28 years – 0m.

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

The CDM project activity will use a renewable crediting period.

C.2.1. Renewable crediting period

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

01/04/2007 or the date of registration or project (whichever is later).

C.2.1.2. Length of the first crediting period:

7 years – 0 m.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

The National Environmental Policy (*PNMA*), instituted by the Law 6.938/81, has the purpose of preservation, improvement and recovery of the environmental quality, with the intention to assure conditions to the social-economic development and the protection to human dignity in the country. The *PNMA* requires previous environmental licenses for the assessment of environmental impacts, and/or other activities that uses environmental resources such as construction, installation and potentially polluting activities or able to cause environmental degradation.

The process of environmental licensing starts with a previous analyses (preliminary studies) of the department of the local environment agency. Later, the project developer prepares an Environmental Impact Assessment (*EIA*) or similar studies. The result of this assessment is the Preliminary License (*Licença Prévia* or *LP*), that reflects the positive understanding of the project environmental concepts by the local or federal ambient agency. In order to get the Installation License (*Licença de Instalação* or *LAI*) it is necessary to present some additional information of the previous analyses; a simplified new assessment and the Environmental Management Plan (*PBA*), in accordance with the specified environmental conditions on the *LP*. The Operating License (*Licença de Operação* or *LO*) authorizes the activity operation after the verification of the attendance of all previous conditions.

The *UHE Mascarenha*s hydro power plant operates since 1974, which is previous to the *PNMA* and the *CONAMA* resolution n. 01/86 and 237/97. Therefore, in order to adjust it to the new legal requirements, an special environmental monitoring analysis was undertaken and the first Operation License was emitted on 1999, renewed in April 18 of 2006, under the number LO 091/2006, Class IV, for the competent agency - State's Institute of Environment - IEMA, to exercise the activity of Electrical Energy Generation – *UHE Mascarenha*s hydro power plant.

The implementation project of the *UHE Mascarenhas* was elaborated and executed for the installation of 3 (three) generation units, with possibility of future installation of a 4th (fourth) generation unit. The project activity will not change the size of the reservoir during the lifetime of the project, reducing and/or eliminating impacts caused by the wadding of the reservoir. For this reason, the impacts caused to the environmental are inexistent, which follows described below. Moreover, the Power plant of *UHE Mascarenhas* has currently a specific waste recycling facility with total separation of water and oil to attend the new generating unit and the others existing units already. The project activity will not have negative impact for the flora and local fauna, since the power plant is already built.

The environmental license agency of the *Espírito Santo* – State's Institute of Environment - *IEMA*, emitted a technical report excusing the necessity of elaboration of specifics environmental studies for the implantation of the fourth generating unit, as transcribed below:

"(...)we understand that an environmental's study for being a technician-scientific analytical procedure, that looks to describe "previsible" environmental impacts, ***before the installation of the project or a potential environmental degradation activity****, it is not applicable in this phase of the project, the same is already in operation since 1974, therefore, before the regulatory act CONAMA n. 001/86 and substantiated by §5º, from article 12 from regulatory act CONAMA n. 006/87"* (Award n. 033/05 dated in march 14 of 2005, page 169).

Commonly, the licence process in Brazil, as well as other environmental norms, is highly exigent based on the best international practices, thus requesting project developers the total fulfilment of the rules and adjustments to the exercise of the energy generation activities in a sustainable way and always aiming a continuous improvement. Within this context, it is also check the adjustment of the Project to the recommendations for large dams of the World Commission on Dams (WCD):

Large dam definition: The International Commission on Large Dams (ICOLD), established in 1928, defines a large dam as a dam with a height of 15m or more from the foundation. If dams are between 5-15m high and have a reservoir volume of more than 3 million m³, they are also classified as large dams. *UHE Mascarenhas* has a reservoir volume of 21.800.000m³ therefore being considered as a large dam.

WCD Checklist:

i) Gaining public acceptance

Amongst the stages of environmental licensing, defined by the article 10 of the Resolution 237/97, is the realization of public audience, when necessary. The Project activity fulfils the environmental conditions established by the Operation License and the others determinations of the *IEMA* and the Brazilian laws. Moreover, environmental education programs were carried out for schools and municipals associations. As result of this, there is a good relationship between the project developer and the local population.

ii) Comprehensive options assessment and addressing existing dams

In opposition of the increasing share of thermal power generation at the Brazilian energy matrix and the large amount of large dams for hydro power plants in Brazil that causers many environmental impacts, the project activity based on clean energy and the use of a water resource that would be otherwise flow out of the dam, the project activity will not cause significant environmental impacts, being by far the best environmental alternative for energy generation.

iii) Sustaining rivers and livelihoods

The project activity will not change the size of the reservoir during the lifetime of the project, reducing and/or eliminating impacts caused by the wadding of the reservoir. Besides the river preservation actions, the most important one for the sustainability of rivers and habitat is the environmental r*ecuperation plan of the power plant* based on the reservoir and power plant affected area (*Plano de Recuperação da Área de Influência Direta da Usina*). The study undertaken aims to monitor the Biodiversity (aquatic Fauna and Ictiofauna) with the implementation of the following monitoring actions; Accomplishment of environmental projects to protect the Biological Reserve and the Municipal historical patrimony of *Itapina*, (municipality bordering the project activity).; Quantitative and qualitative monitoring of the *Doce* River; execution of projects of reforestation; and others. The *project activity* does not affect the local economy of the local population due that there is not fishing activity for subsistence.

iv) Recognizing entitlements and sharing benefits

There is no population displacement and no negative effects to the communities´ interests and rights related to the project. The sharing of benefits can be verified through the generation of jobs and the use of local workers, contributing for income generation.

Degraded areas are also being renewed through the reforestation of riparian areas. Likewise, the population, indirectly, will be benefited from the taxes generated from the energy sale. This surplus in the region can be translated into new investments in infrastructure, productive capacity and basic necessities of the population (education and health).

v) Compliance

The compliance of the project activity with the conditions established by the World Commission on Dams as well as with the criteria of sustainable development is based on the fulfilment of all national environmental legislation, specially the CONAMA Resolution n° 237/97, Law 6938/81 and Law 9605/98. This set of legislation regulates the environment licenses, the National Environmental Policy and Environmental Crimes. Moreover, the project obeys the pertinent energy regulations and resolutions instituted by the ANEEL and related norms.

vi) Sharing rivers for peace, development, and security

The base of the economic activity of *Baixo Guandu* is cattle raising. There is a small registry of industrial activity, characterized by the production of ceramics, confection of clothes, *cachaça*, wood and metal frames, all of them typical to urban areas.

In that sense, it is possible to observe that the use of the river for energy generation will not stop local subsistence activities and will also contribute to the regional integration through generation and distribution of electric energy. As to the electrification services, they are considered satisfactory, practically covering all the households, especially in the urban area, contributing for the life quality of the people, development of the region and the security of the population.

The UHE Mascarenhas presents significants aspects regarding environmental factors inside the local and the region. Thus, the optimizing of river by UHE Mascarenhas does not stagnate the subsistence activities in the region and contributes to the regional integration for electricity generation and distribution.

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 environmental impacts were not considered significant. The studies carried out for the implantation of the fourth generation unit did not detected serious impacts. Furthermore it was not necessary to open new accesses and the leftovers of construction materials are conditioned and withdrawals of project after its ending.

SECTION E. Stakeholders' comments

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

Acording to the Resolution number 1 of the Brazilian Inter-Ministerial commission on Climate Change[34], invitations for comments by local stakeholders are required by the Brazilian Designated National Authority (DNA) as part of the procedures for analyzing CDM projects and issuing letters of approval.

The DNA required project participants to communicate with the public through letters, to be sent inviting for comments to:

- The Brazilian national NGO's forum.
- The local attorneys' and prosecutors' agency.
- The municipality's chamber (mayor and assembly men).
- State's and municipal's environmental authorities.
- Local communities' associations.

As defined by the Designated National Authority (DNA), the project developer sent information letters to the key institutions (see table 10, below) describing the major aspects of the implementation and operation of the proposed project.

[34] *Issued on December 2nd of the 2003, decree from July 7th 1999.*

Name of the Institution	Type of Entity	Address	Phone / Fax	Contact Point	E-mail
ADERES -Grid Development Agency of *Espírito Santo*	Public	*Vitória* Avenue, 2045, 3rd floor Zip code: 29.040.780 *Vitória, Espírito Santo*	(27) 3322-8282	*Edson Caetano da Silva*	bressan@sedetur.es.gov.br
Municipal City Hall of *Colatina*	City Hall	*Ângelo Gilberti* Avenue,343 Zip code: 29.702.902 *Colatina, Espírito Santo.*	(27) 3177-7000	*João Guerino Balestrassi*	prefeitura@colatina.es.gov.br
Autonomous Work of Water and Sewer of *Baixo Guandú - SAAE- ES*	Private	*10 de abril* Avenue,390 *Baixo Guandu, Espírito Santo*	(27) 3732-1117	*Ronaldo Alves Pereira*	saaebgu@logosnet.com.br
Fishing Association of *Baixo Guandu*	NGO	P.O Box 72 Zip code: 29.730.000 *Baixo Guandu, Espírito Santo*	--	*João Rocha Ribeiro*	--
Light and Force Company of *Santa Maria*	Private	*Ângelo Giuberti* Avenue 385 P.O Box: 30 Zip code: 29.702-900 *Colatina, Espírito Santo*	(27) 3723-2323	*Henrique Barbieri Coutinho*	elfsm@colatina.com.br
Agricultural Workers Union	NGO	*Adamastor Salvador* Street, 421 Zip code: 29-700-050 *Colatina, Espírito Santo.*	(27) 3722-2988	*Maria Emilia Brumatti*	str@strcolatina.com.br
Movimento Pró Rio Doce	Private	*Rio* Doce Avenue, 4160 Zip code: 35.020-500 Gov. Valadares, Espírito Santo.	(33) 3275-1804	*Joema Gonçalves de Alvarenga*	movriodoce@uol.com.br
Brazilian NGO´s Forum	NGO	SCLN 210 Block C Room 102 Zip code: 70856-530 *Brasília - Distrito Federal*	(61) 3340-0741	--	forumbr@tba.com.br
City Council of *Baixo Guandu*	*Public*	*Carlos de Medeiros* Avenue, nº 59 Zip code: 29.730.000 *Baixo Guandu, Espírito Santo.*	(27) 3732-4556	*Zé Russo*	--
City Council of *Colatina*	*Public*	*Professor Arnaldo de Vasconcelos Costa Street* nº 32 Zip code: 29700-220	(27) 3722-3036	*Syro Tedoldi Neto Segundo*	--
City Council of *Vitória*	*Public*	*Mal. Mascarenhas de Moraes Street*, nº 1788 Zip code: 29052-120.	(27) 3334-4626	*Alexandre Passos*	--
Environment State Institute	Public	Km 0, BR 262 Road, *Cariacica, Espírito Santo,* ZIP Code; 29140-500	(27) 3136 3434/ 3136 3436	*Sueli Passoni Tonini*	--
Public Ministry of Vitória	*Public*	*350 Humberto Martins de Paula Street, Vitória, Espírito Santo, ZIP Code: 29050-265.*	*(27) 3224 4500*	--	--
Public Ministry of *Baixo Guandu*	Public	30, *Ibituba* Street, *Baixo Guandu, Espírito Santo*, ZIP Code: 29 730-000.	(27) 3732 1544	*Attorney José Eugênio Rosetti Machado*	--
Baixo Guandu City Hall	City Hall	217 Fritz Von Lutzow Street, Baixo Guandu, Espírito Santo, ZIP Code: 29730-000	(27) 37324562/ 3732 4638	*Mayor José Francisco de Barros*	--

Hydraulic Resources State Council - *CERH*	Public	Km 0, BR 262 Road, *Cariacica, Espírito Santo*, ZIP Code: 29 140-500	(27) 3136 3508/ 3510	President *Maria da Glória Brito Abaurre*	--
Doce River Basin Committee	Civil Association	4000, *Brasil* Avenue, *Governador Valadares, Minas Gerais*, ZIP Code: 35010-070.	(33) 3276 5477	President J*oão Guerino Balestrassi*	--
Guandu River Association	Civil Association	*Dez de Abreu* Avenue, *Baixo Guandu, Espírito Santo*, ZIP Code: 29 730 000.	(27) 3732 8374/ 9114	*Gisele Moreira*	--
Environment Secretariat of the State of Espírito Santo - *SEAMA*	Public	Km 0, BR 262 Road, *Cariacica, Espírito Santo,* ZIP Code: 29 140-500	(27) 3136-3438 / 3443	*Luiz Fernandes Shiettno*	presidente@iema.es.gov.br
I*nstituto de Defesa Agropecuária Florestal – IDAF*	Public	135 *Raimundo Nonato* Street, *Vitória, Espírito Santo,* ZIP Code: 29 010-540.	(27) 31321514	Director *Paulo Roberto Viana de Araújo*	dipre@idaf.es.gov.br
Environmental Police of *Colatina*	Public	249, *Ambiental* Street, *Colatina, Espírito Santo,* ZIP Code: 29704-380.	(27) 3711 8151	*Ricardo dos Passos Lírio*	-
Instituto Capixaba de Pesquisa, Assistência Técnica e Extensão Rural - INCAPER	Public	*Afonso Salo* Street,160 *Vitória, Espírito Santo*.	(27) 3325 3111	--	central@incaper.es.gov.br
SANEAR – Serviço Colatinense de Meio Ambiente e Saneamento Ambiental	Association	105, *Benjamin Costa* Street, *Colatina, Espírito Santo.*	-	*Janaína*	sanear.dir@zaz.com.br
Professora Matilde G. Comério Municipal School	Public	*Castelo Branco* Street, Colatina, *Espírito Santo*, ZIP Code: 29 700-970.	(27) 3721 4504 / 4663	*Ivanuze Pimenta Barbosa*	matildeguerra@ig.com.br

Table 10.Participant entities.

E.2. Summary of the comments received:

To date, no comments have been received.

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

Not applicable, given that no comments were received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	*ENERGEST S.A.*
Street/P.O.Box:	Rua Bandeira Paulista, nº 530, 11º andar
Building:	Bandeira Tower
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	04532-001
Country:	Brazil
Telephone:	+55 11 2185 5900
FAX:	+55 11 2185 5914
URL:	www.energiasdobrasil.com.br
Title:	Eng.º
Salutation:	Mr
Last Name:	Sirgado
Middle Name:	Miguel
First Name:	Pedro
Department:	Meio Ambiente e Sustentabilidade
Mobile:	+ 55 11 9966 1498 / 11 8245 0093
Direct FAX:	+ 55 11 2185 5987
Direct tel:	+ 55 11 2185 5955
Personal E-Mail:	pedro.sirgado@energiasdobrasil.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There are no public financing for the project.

Annex 3

BASELINE INFORMATION

Below, the graphs representing the duration load curve and the energy demand for 2003, 2004 and 2005. Data were sourced directly from the ONS (National operator system) for the project electrical system and project boundary (South East/ Central West and South system).

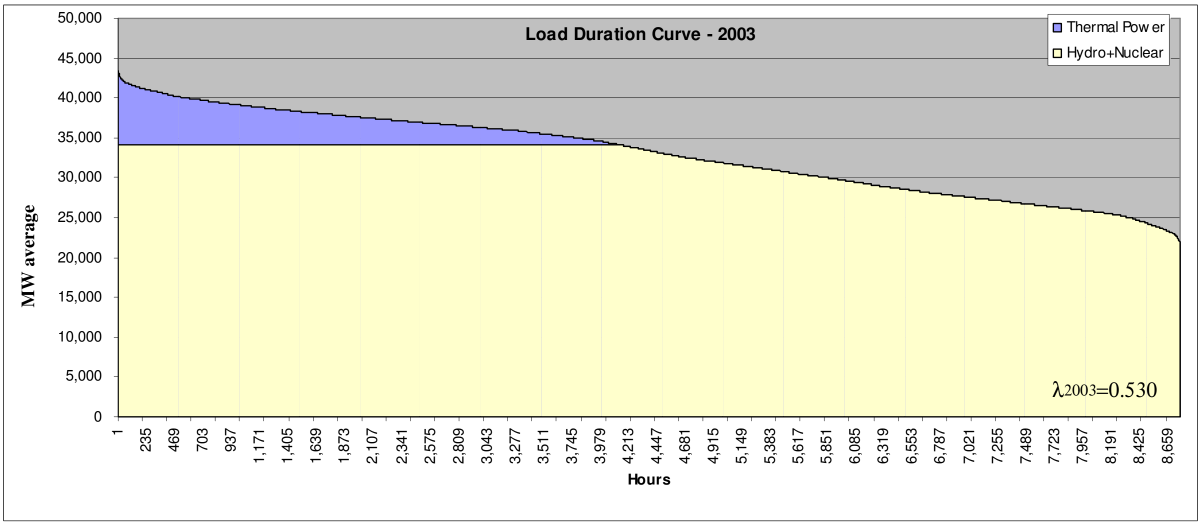

Figure 1.Load duration curve 2003 for the South – South East – Central West system

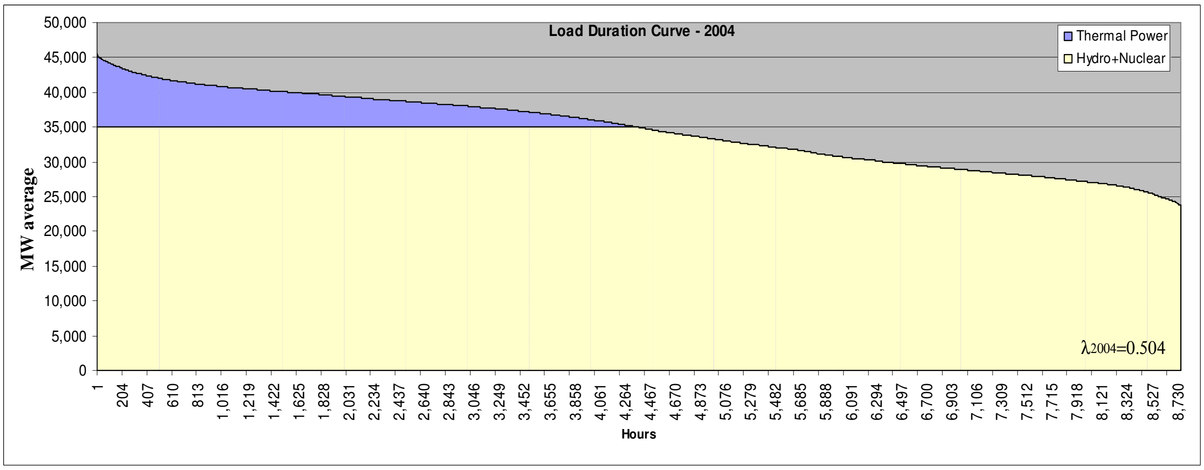

Figure 2. Load duration curve 2004 for the South – South East – Central West system

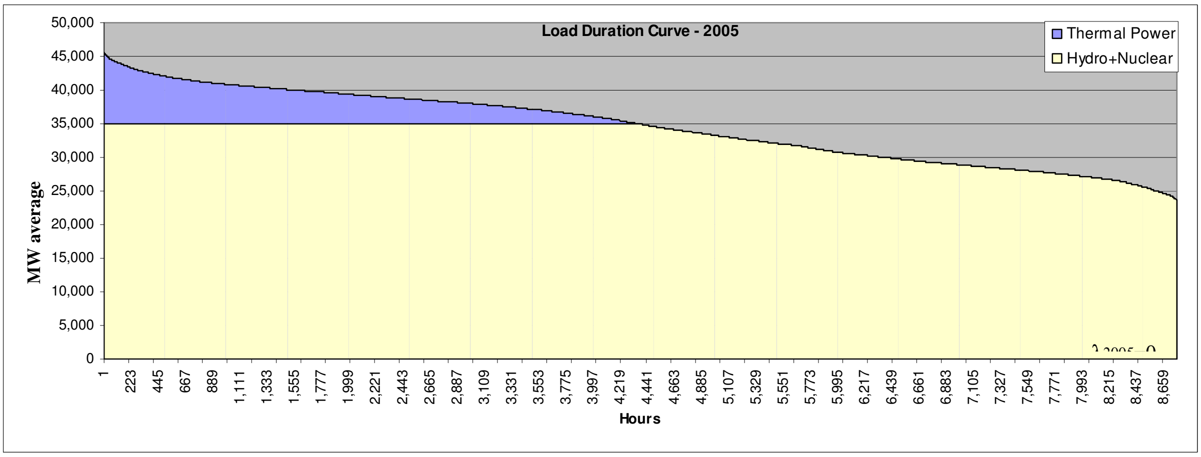

Figure 3. Load duration curve 2005 for the South – South East – Central West system

The table below represents the lead time values agreed for new capacity additions used at the baseline weighting values estimated. The assumptions are currently used in the US government's energy modelling. These are consistent with the coal and gas numbers from the OECD/IEA report, and include lead time estimates for other electric generating technologies. An assumption of three or four years would appear to be reasonable for many fossil and renewable generating technologies.

Technology	Lead time (in years)
Coal	4
Natural Gas (CC)	3
Combustion turbine	2
Nuclear	6
Wind	3
Biomass	4

Table 11. ***Lead time estimation for electric generating technologies.***.[35]

At the definition of the baseline, the set of power plants (low cost/must run resources) are analysed as well those power plants non-low cost/must run power plants. The table below shows the installed capacity for the hydro power plants within the project boundary of the project activity.

Hydro Power plant	Installed power (KW) (2006)	Municipality	2003	2004	2005
Água Vermelha	1,396,200	Indiaporã - SP/Iturama	1,396,200	1,396,200	1,396,200
Americana	30,000	Americana - SP	30,000	30,000	30,000
Antas II	16,800	Poços de Caldas - MG	16,800	16,800	16,800
Antônio Brennand	20,020	Araputanga - MT	20,020	20,020	20,020
Apucaraninha	10,000	Tamarana - PR	10,000	10,000	10,000
Areal	18,000	Areal - RJ	18,000	18,000	18,000
Assis Chateaubrind	29,500	Ribas do Rio Pardo - MS	29,500	29,500	29,500
Bariri (Alvaro de Souza Lima)	143,100	Boracéia - SP	143,100	143,100	143,100

[35] *Source: OECD/IEA report: Projected Cost of Generating Electricity*

Barra Bonita	140,760	Barra Bonita - SP	140,760	140,760	140,760
Baruíto	18,300	Campo Novo do Parecis	18,300	18,300	18,300
Benjamim Mário Baptista	9,000	Manhuaçu - MG	9,000	9,000	9,000
Bracinho	17,700	Schroeder - SC	17,700	17,700	17,700
Braço do Norte II	10,752	Guarantã do Norte - MT	10,752	10,752	10,752
Braço Norte	5,180	Guarantã do Norte - MT	5,180	5,180	5,180
Bugres	11,500	Canela - RS	11,500	11,500	11,500
Cachoeira Dourada	658,000	Cachoeira Dourada - MG	658,000	658,000	658,000
Caconde	80,400	Caconde - SP	80,400	80,400	80,400
Camargos	46,000	Itutinga - MG/Nazareno - MG	46,000	46,000	46,000
Cana Brava	465,900	Cavalcante - GO / Minaçu	465,900	465,900	465,900
Canastra	44,000	Canela - RS	44,000	44,000	44,000
Canoas I	82,500	Itambaracá - PR / Cândido Mota - SP	82,500	82,500	82,500
Canoas II	72,000	Andirá - PR / Palmital - SP	72,000	72,000	72,000
Capão Preto	5,520	São Carlos - SP	5,520	5,520	5,520
Capivara	640,000	Porecatu - PR / Taciba - SP	640,000	640,000	640,000
Casca III	12,420	Chapada dos Guimarães - MT	12,420	12,420	12,420
Cedros (Rio dos Cedros)	8,400	Rio dos Cedros - SC	8,400	8,400	8,400
Celso Ramos	5,400	Faxinal dos Guedes - SC	5,400	5,400	5,400
Chaminé	18,000	São José dos Pinhais - PR	18,000	18,000	18,000
Chavantes	414,000	Chavantes - SP / Ribeirão Claro	414,000	414,000	414,000
Coronel Domiciano	5,040	Muriaé - MG	5,040	5,040	5,040
Corumbá I	375,000	Caldas Novas - GO	375,000	375,000	375,000
Costa Rica	16,000	Costa Rica - MS	16,000	16,000	16,000
Derivação do Rio Jordão	6,500	Reserva do Iguaçu - PR	6,500	6,500	6,500
Dona Francisca	125,000	Nova Palma - RS / Agudo	125,000	125,000	125,000
Dourados	10,800	Nuporanga - SP	10,800	10,800	10,800
Eloy Chaves	19,000	Espírito Santo do Pinhal - SP	19,000	19,000	19,000
Emborcação	1,192,000	Cascalho Rico - MG/ Catalão -	1,192,000	1,192,000	1,192,000
Ervália	6,970	Guiricema - MG / Ervália - MG	6,970	6,970	6,970
Esmeril	5,040	Patrocínio Paulista - SP	5,040	5,040	5,040
Estreito -Luiz Carlos Barreto	1,050,000	Sacramento - MG/ Rifaina - SP	1,050,000	1,050,000	1,050,000
Euclides da Cunha	108,800	São José do Rio Pardo - SP	108,800	108,800	108,800
Fontes Nova	130,300	Piraí - RJ	130,300	130,300	130,300
Fruteiras	8,736	Cachoeiro de Itapemirim - ES	8,736	8,736	8,736
Funil	216,000	Itatiaia - RJ	216,000	216,000	216,000
Furnas	1,216,000	Alpinópolis - MG	1,216,000	1,216,000	1,216,000
Gafanhoto	14,000	Divinópolis - MG	14,000	14,000	14,000
Garcia	8,920	Angelina - SC	8,920	8,920	8,920
Governador Bento Munhoz da Rocha Neto (Foz do Areia)	1.676.000	Pinhão - PR	1,676,000	1,676,000	1,676,000
Governador José Richa	1.240.000	Capitão Leônidas Marques	1,240,000	1,240,000	1240000
Governador Ney Aminthas de Barros Braga (Segredo)	1.260.000	Mangueirinha - PR	1,260,000	1,260,000	1,260,000
Governador Parigot de Souza (Capivari/Cachoeira)	260,000	Antonina - PR	260,000	260,000	260,000
Guaricana	36,000	Guaratuba - PR	36,000	36,000	36,000
Henry Borden	889,000	Cubatão - SP	889,000	889,000	889,000
Ibitinga	131,490	Ibitinga - SP	131,490	131,490	131,490
Igarapava	210,000	Conquista - MG/ Igarapava - SP	210,000	210,000	210,000
Ilha dos Pombos	187,169	Além Paraíba - MG/ Carmo - RJ	187,169	187,169	187,169
Ilha Solteira	3,444,000	Ilha Solteira - SP/Selvíria - MS	3,444,000	3,444,000	3,444,000
Itá	1,450,000	Aratiba - RS / Itá - SC	1,450,000	1,450,000	1,450,000
Itaipu (Parte Brasileira)	6.300.000	Foz do Iguaçu - PR	6,300,000	6,300,000	6,300,000
Itatinga	15,000	Bertioga - SP	15,000	15,000	15,000

Itaúba	512,400	Pinhal Grande - RS	512,400	512,400	512,400
Itumbiara	2,082,000	Araporã - MG / Itumbiara	2,082,000	2,082,000	2,082,000
Itutinga	52,000	Itutinga - MG	52,000	52,000	52,000
Jacuí	180,000	Salto do Jacuí - RS	180,000	180,000	180,000
Jaguara	424,000	Rifaina - SP /Sacramento	424,000	424,000	424,000
Jaguari	11,800	Pedreira - SP	11,800	11,800	11,800
Jaguari	27600	Jacareí - SP	27600	27600	27600
João Camilo Penna	21,600	Raul Soares - MG	21,600	21,600	21,600
Joasal	8,400	Juiz de Fora - MG	8,400	8,400	8,400
Júlio de Mesquita Filho	29,072	Cruzeiro do Iguaçu - PR	29,072	29,072	29,072
Jupiá (Eng° Souza Dias)	1,551,200	Castilho - SP/Três Lagoas - MS	1,551,200	1,551,200	1,551,200
Jurumirim	97,700	Cerqueira César - SP	97,700	97,700	97,700
Limoeiro (Armando Salles de Oliveira)	32,000	São José do Rio Pardo - SP	32,000	32,000	32,000
Macabu	21,000	Trajano de Morais - RJ	21,000	21,000	21,000
Machadinho	1,140,000	Maximiliano de Almeida - RS / Piratuba - SC	1,140,000	1,140,000	1,140,000
Manso	210,000	Chapada dos Guimarães	210,000	210,000	210,000
Marechal Mascarenhas de Moraes	478,000	Ibiraci - MG/ Sacramento	478,000	478,000	478,000
Marimbondo	1,440,000	Fronteira - MG / Icém - SP	1,440,000	1,440,000	1,440,000
Martins	7,700	Uberlândia - MG	7,700	7,700	7,700
Mascarenhas	130,000	Aimorés - MG	130,000	130,000	130,000
Miranda	408,000	Indianópolis	408,000	408,000	408,000
Mogi-Guaçu	7,200	Mogi Guaçu - SP	7,200	7,200	7,200
Mourão I	8,200	Campo Mourão - PR	8,200	8,200	8,200
Neblina	6,468	Ipanema - MG	6,468	6,468	6,468
Nilo Peçanha	378,420	Piraí - RJ	378,420	378,420	378,420
Nova Avanhandava (Rui Barbosa)	347,400	Buritama - SP	347,400	347,400	347,400
Nova Ponte	510,000	Nova Ponte - MG	510,000	510,000	510,000
Padre Carlos (Ex- PCH Rolador)	7800	Poços de Caldas - MG	7800	7800	7800
Palmeiras	24,602	Rio dos Cedros - SC	24,602	24,602	24,602
Paraibuna	85,000	Paraibuna - SP	85,000	85,000	85,000
Paranapanema	29,840	Piraju - SP	29,840	29,840	29,840
Paranoá	29,700	Brasília - DF	29,700	29,700	29,700
Passo do Meio	30,000	São Francisco de Paula	30,000	30,000	30,000
Passo Fundo	226,000	Entre Rios do Sul - RS	226,000	226,000	226,000
Passo Real	158,000	Salto do Jacuí - RS	158,000	158,000	158,000
Pedrinho I	16,200	Boa Ventura	16,200	16,200	16,200
Pereira Passos	99,110	Piraí - RJ	99,110	99,110	99,110
Peti	9,400	São Gonçalo	9,400	9,400	9,400
Piabanha	9,000	Areal - RJ	9,000	9,000	9,000
Piau	18,012	Santos Dumont - MG	18,012	18,012	18,012
Pinhal	6,800	Espírito Santo do Pinhal	6,800	6,800	6,800
Poço Fundo	9,160	Poço Fundo - MG	9,160	9,160	9,160
Porto Colômbia	320,000	Guaíra - SP / Planura - MG	320,000	320,000	320,000
Porto Estrela	112,000	Açucena - MG/ Braúnas	112,000	112,000	112,000
Porto Primavera	1,540,000	Anaurilândia - MS	1,430,000	1,540,000	1,540,000
Primavera	8,120	Poxoréo - MT	8,120	8,120	8,120
Promissão (Mário Lopes Leão)	264,000	Ubarana - SP	264,000	264,000	264,000
Rasgão	22,000	Pirapora do Bom Jesus	22,000	22,000	22,000
Rio Bonito	16,800	Santa Maria de Jetibá - ES	16,800	16,800	16,800
Rio de Pedras	9,280	Itabirito - MG	9,280	9,280	9,280
Rio do Peixe (Casa de Força I e II)	18,060	São José do Rio Pardo - SP	18,060	18,060	18,060
Rosal	55,000	Bom Jesus - RJ	55,000	55,000	55,000
Rosana	369,200	Rosana - SP	369,200	369,200	369,200
Sá Carvalho	78,000	Antônio Dias - MG	78,000	78,000	78,000
Salto (Salto Weissbach)	6,280	Blumenau - SC	6,280	6,280	6,280
Salto Grande	102,000	Braúnas - MG	102,000	102,000	102,000
Salto Grande	70,000	Cambará - PR / Salto Grande	70,000	70,000	70,000
Salto Osório	1.078.000	Quedas do Iguaçu - PR	1,078,000	1,078,000	1,078,000
Salto Santiago	1,420,000	Saudade do Iguaçu - PR	1,420,000	1,420,000	1,420,000
Santa Branca	56,050	Jacareí - SP/ Santa Branca	56050	56050	56050
Santa Cecília	34,960	Barra do Piraí - RJ	34,960	34,960	34,960
Santa Lúcia	5,000	Sapezal - MT	5,000	5,000	5,000
São Bernardo	6,820	Piranguçu - MG	6,820	6,820	6,820
São Domingos	14,336	São Domingos - GO	14,336	14,336	14,336

São Joaquim	8,050	Guará - SP	8,050	8,050	8,050
São Simão	1,710,000	Santa Vitória - MG	1,710,000	1,710,000	1,710,000
Serra da Mesa	1,275,000	Cavalcante - GO / Minaçu	1,275,000	1,275,000	1,275,000
Suíça	30060	Santa Leopoldina - ES	30060	30060	30060
Taquaruçu (Escola Politécnica)	554,000	Sandovalina - SP / Santa Inês	554,000	554,000	554,000
Três Irmãos	807,500	Pereira Barreto - SP	807,500	807,500	807,500
Três Marias	396,000	Três Marias - MG	396,000	396,000	396,000
Tronqueiras	8,500	Coroaci - MG	8,500	8,500	8,500
Vigário	90,820	Piraí - RJ	90,820	90,820	90,820
Volta Grande	380,000	Conceição das Alagoas - MG	380,000	380,000	380,000
Braço Norte III	14,160	Guarantã do Norte - MT	14,160	14,160	14,160
Funil	180,000	Lavras - MG / Perdões - MG	180,000	180,000	180,000
Itiquira (Casas de Forças I e II)	156,060	Itiquira - MT	108,400	156,060	156,060
Ivan Botelho I (Ex-Ponte)	24,400	Descoberto - MG / Guarani	24,400	24,400	24,400
Ombreiras	26,000	Araputanga - MT/ Jauru - MT	26,000	26,000	26,000
Paraíso I	21,600	Costa Rica - MS	21,600	21,600	21,600
Pesqueiro	12,440	Jaguariaíva - PR	10,960	10,960	12,440
Salto Natal	15,120	Campo Mourão - PR	14,000	15,120	15,120
Salto Voltão	8,200	Xanxerê - SC	6,760	6,760	8,200
Santa Lúcia II	7,600	Sapezal - MT	7,600	7,600	7,600
Vitorino	5,280	Itapejara d´Oeste - PR	5,280	5,280	5,280
Faxinal II	10,000	Aripuanã - MT	0	10,000	10,000
Ferradura	9,200	Redentora - RS / Erval	0	9,200	9,200
Furnas do Segredo	9,800	Jaguari - RS	0	9,800	9,800
Indiavaí	28,000	Indiavaí - MT / Jauru - MT	0	28,000	28,000
Jauru	121,500	Indiavaí - MT/Jauru - MT	0	121,500	121,500
Ourinhos	44,000	Jacarezinho - PR / Ourinhos	0	44,000	44,000
Porto Góes	24,800	Salto - SP	11000	24,800	24,800
Quebra Queixo	121,500	Ipuaçu - SC / São Domingos	0	121,500	121,500
Queimado	105,000	Cristalina - GO /Unaí - MG	0	105,000	105,000
Salto Corgão	27,000	Nova Lacerda - MT	0	27,000	27,000
Túlio Cordeiro de Mello	15,800	Abre Campo - MG	14,000	15,800	15,800
Aimorés	330000	Aimorés - MG	0	0	0
Barra Grande	465,500	Anita Garibaldi - SC	0	0	0
Candonga	140,000	Rio Doce - MG/	0	0	140,000
Ivan Botelho II (Ex-Palestina)	12480	Guarani - MG	0	0	12480
Ivan Botelho III (Ex-Triunfo)	24,400	Astolfo Dutra - MG	0	0	24,400
Monte Claro	65,000	Bento Gonçalves - RS	0	0	65,000
Ormeo Junqueira Botelho	22,700	Muriaé - MG	0	0	22,700
Ponte de Pedra	176,100	Itiquira - MT/Sonora - MS	0	0	0
Santa Clara	60,000	Nanuque - MG	0	0	60,000
Santa Clara	120,168	Candói - PR / Pinhão - PR	0	0	60,000
Santa Edwiges II	12,100	Buritinópolis - GO	0	0	0
Xavier	6,006	Nova Friburgo - RJ	5,280	5,280	6,006
TOTAL			**48,128,177**	**48,778,557**	**49,166,783**

*Table 12. **Installed capacity of the hydro power plants.***

The table below shows the installed capacity for the ***thermal based power plants*** within the project boundary of the project activity.

Power plant	Installed Power (kW)	Fuel type	2003	2004	2005
Alberto - Unidade I)	657,000	Uranium	657,000	657,000	657,000
Alegrete	66,000	Fuel Oil	66,000	66,000	66,000
Angra II	1,350,000	Uranium	1,350,000	1,350,000	1,350,000
Araucária	484,500	Natural Gas	484,500	484,500	484,500
Brahma	13,080	Natural Gas	13,080	13,080	13,080
Brasília	10,000	Diesel Oil	10,000	10,000	10,000
Campos	30,000	Natural Gas	30,000	30,000	30,000
Carapina Brasympe	43,500	Diesel Oil	43,500	43,500	43,500
Carioba	36,160	Diesel Oil	36,160	36,160	36,160

Casa F-242	9,000	Natural Gas	9,000	9,000	9,000
Charqueadas	72,000	Coal	72,000	72,000	72,000
Civit Brasympe	22,510	Diesel Oil	22,510	22,510	22,510
Copesul	74,400	Residual Gas	74,400	74,400	74,400
Cuiabá	529,200	Natural Gas	529,200	529,200	529,200
Daia	44,300	Diesel Oil	44,300	44,300	44,300
Eletrobolt	379,000	Natural Gas	379,000	379,000	379,000
Energy Works Kaiser	8,592	Natural Gas	8,592	8,592	8,592
Energy Works Rhodia	11,000	Natural Gas	11,000	11,000	11,000
Eucatex	9,800	Natural Gas	9,800	9,800	9,800
Figueira	20,000	Coal	20,000	20,000	20,000
Igarapé	131,000	Heavy Oil	131,000	131,000	131,000
Ipatinga	40,000	BGC gas	40,000	40,000	40,000
Jorge Lacerda I e II	232,000	Coal	232,000	232,000	232,000
Jorge Lacerda III	262,000	Coal	262,000	262,000	262,000
Jorge Lacerda IV	363,000	Coal	363,000	363,000	363,000
Macaé Merchant	922,615	Natural Gas	922,615	922,615	922,615
Negro de Fumo	24,400	Residual Gas	24,400	24,400	24,400
Nutepa	24,000	Fuel Oil	24,000	24,000	24,000
Piratininga	472,000	Fuel Oil	472,000	472,000	472,000
Ponta de Ubu Brasympe	42,640	Diesel Oil	42,640	42,640	42,640
Presidente Médici A/B	446,000	Coal	446,000	446,000	446,000
São Jerônimo	20,000	Coal	20,000	20,000	20,000
São José do Rio Claro	5,699	Diesel Oil	5,224	5,224	5,224
Sapezal	8,130	Diesel Oil	9,836	9,836	9,836
Tubarão Brasympe	42,640	Diesel Oil	42,640	42,640	42,640
UGPU (Messer)	7,700	Natural Gas	7,700	7,700	7,700
Uruguaiana	639,900	Natural Gas	639,900	639,900	639,900
Vila Rica	9,252	Diesel Oil	4,672	7,520	9,252
Canoas	160,573	Natural Gas	160,573	160,573	160,573
Capuava	18,020	Fuel Oil	18,020	18,020	18,020
EnergyWorks Corn Products Balsa	9,199	Natural Gas	9,199	9,199	9,199
Ibirité	226,000	Natural Gas	226,000	226,000	226,000
Modular de Campo Grande	194,000	Natural Gas	194,000	194,000	194,000
Xavantes Aruanã	53,576	Diesel Oil	53,576	53,576	53,576
Barreiro	12,900	BGC gas	-	12,900	12,900
Colniza	5,564	Diesel Oil	3,336	5,564	5,564
Rhodia Paulínia	10,000	Natural Gas	-	10,000	10,000
Corn Products Mogi	30,775	Natural Gas	-	30,775	30,775
Juiz de Fora	87,048	Natural Gas	82,000	87,048	87,048
Norte Fluminense	868,925	Natural Gas	-	868,925	868,925
Nova Piratininga	386,080	Natural Gas	-	386,080	386,080
Santa Cruz	766,000	Natural Gas	600,000	766,000	766,000
Três Lagoas	306,000	Natural Gas	-	240,000	306,000
TermoRio	793,050	Natural Gas	-	-	793,050
TOTAL			**8,906,373**	**10,631,177**	**11,491,959**

Table 13. *Installed capacity of the thermal power plants*

Annex 4:

MONITORING PLAN

Please refer to section B.7.2.

Annex 5

CASH FLOW ANALYSIS

Here below the project activity cash flow analysis. The project cash flow and the financial indicators of the project activity have been based on the data provided by the project developer.

ANALYSIS OF THE 4º MASCARENHAS MACHINE

1U$ Dollar = R$ 3,07 (Quoted at the time)

Especifications	2003	2004	2005	2006	2007	2008	2009	2010
FIXED ASSETS								
Investments		8,387	9,628	1,539				
Accumulated balance		8,387	18,015	19,554	19,554	19,554	19,554	19,554
ACCRUED DEPRECIATIONS								
Avarage Unit (3%/yr)					587	587	587	587
Accumulated balance					587	1,173	1,760	2,346
REMUNERABLE INVEST.					**18,967**	**18,381**	**17,794**	**17,207**
Demonstration of Year-end results								
INCOMES					1,593	3,722	3,622	3,522
Investiment Remuneration					1,348	3,136	3,036	2,936
Depreciation Unit					244	587	587	587
(-) Vat taxes					74	173	168	164
(-) Depriciation Unit					244	587	587	587
(=) Operating Income					**1,274**	**2,963**	**2,867**	**2,772**
(-) Financial Expense					0	0	0	0
(=) Profit before income tax					**1,274**	**2,963**	**2,867**	**2,772**
(-) Taxes					433	1,007	975	942
(=) Added Net Profit					**1,707**	**3,970**	**3,842**	**3,714**

ANALYSIS OF THE 4º MASCARENHAS MACHINE

		1	*2*	*3*	*4*	*5*	*6*	*7*
Especifications	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
NET CASH FLOW (Shareholder)								
Net Profit + Depreciation					1,952	4,557	4,429	4,301
(-) Paid Encharges before the operation		0	0	0	0	0	0	0
(-) Amortizations		0	0	0	0	0	0	0
(=) NCF Addition	**(19,554)**	**0**	**0**	**0**	**1,952**	**4,557**	**4,429**	**4,301**
	(19,554)	0	0	0	1,127	2,293	1,943	1,645
Net Present Value NCF	**(3,931)**							
IRR	**12.16%**			**attractiveness tax (after de taxes)**			**14.72%**	

CONSIDERATIONS:		**BNDES funding :**
Necessary investments	19,554	Investiment in the 4º Machine of the Mascarenhas Hidro Power Plant
(-) Value that will return to the BNDES		Aproved Funding of BNDES (70%)
(-) Additional Draft BNDES		Draft in 2001+ penalty :

ANALYSIS OF THE 4º MASCARENHAS MACHINE (continuing)

Especifications	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
FIXED ASSETS															
Investiments															
Accumulated balance	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554
ACCRUED DEPRECIATIONS															
Avarage Unit (3%/yr)	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
Accumulated balance	2,933	3,520	4,106	4,693	5,280	5,866	6,453	7,039	7,626	8,213	8,799	9,386	9,972	10,559	11,146
REMUNERABLE INVEST.	**16,621**	**16,034**	**15,448**	**14,861**	**14,274**	**13,688**	**13,101**	**12,514**	**11,928**	**11,341**	**10,755**	**10,168**	**9,581**	**8,995**	**8,408**
Demonstration of Year-end results															
INCOMES	3,422	3,322	3,222	3,122	3,022	2,922	2,822	2,722	2,622	2,521	2,421	2,321	2,221	2,121	2,021
Investiment Remuneration	2,836	2,735	2,635	2,535	2,435	2,335	2,235	2,135	2,035	1,935	1,835	1,735	1,635	1,535	1,434
Depreciation Unit	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
(-) Vat taxes	159	154	150	145	141	136	131	127	122	117	113	108	103	99	94
(-) Depriciation Unit	587	587	587	587	587	587	587	587	587	587	587	587	587	587	587
(=) Operating Income	**2,676**	**2,581**	**2,486**	**2,390**	**2,295**	**2,199**	**2,104**	**2,008**	**1,913**	**1,818**	**1,722**	**1,627**	**1,531**	**1,436**	**1,340**
(-) Financial Expense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(=) Profit before income tax	**2,676**	**2,581**	**2,486**	**2,390**	**2,295**	**2,199**	**2,104**	**2,008**	**1,913**	**1,818**	**1,722**	**1,627**	**1,531**	**1,436**	**1,340**
(-) Taxes	910	878	845	813	780	748	715	683	650	618	586	553	521	488	456
(=) Added Net Profit	**3,586**	**3,458**	**3,331**	**3,203**	**3,075**	**2,947**	**2,819**	**2,691**	**2,563**	**2,436**	**2,308**	**2,180**	**2,052**	**1,924**	**1,796**

ANALYSIS OF THE 4º MASCARENHAS MACHINE

	8	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*
Especifications	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
NET CASH FLOW (Shareholder)															
Net Profit + Depreciation	4,173	4,045	3,917	3,789	3,661	3,534	3,406	3,278	3,150	3,022	2,894	2,766	2,639	2,511	2,383
(-) Paid Encharges before the operatio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(-) Amortizations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(=) NCF Addition	**4,173**	**4,045**	**3,917**	**3,789**	**3,661**	**3,534**	**3,406**	**3,278**	**3,150**	**3,022**	**2,894**	**2,766**	**2,639**	**2,511**	**2,383**
	1,391	1,175	992	837	705	593	498	418	350	293	244	204	169	140	116

ANALYSIS OF THE 4º MASCARENHAS MACH (continuing)

Especifications	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
FIXED ASSETS															
Investiments															
Accumulated balance	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554	19,554
ACCRUED DEPRECIATIONS															
Avarage Unit (3%/yr)	587	587	587	587	587	587	587	587	587	587	587	587	587	587	600
Accumulated balance	11,732	12,319	12,906	13,492	14,079	14,665	15,252	15,839	16,425	17,012	17,598	18,185	18,772	19,358	19,958
REMUNERABLE INVEST.	**7,822**	**7,235**	**6,648**	**6,062**	**5,475**	**4,888**	**4,302**	**3,715**	**3,129**	**2,542**	**1,955**	**1,369**	**782**	**196**	**(404)**
Demonstration of Year-end results															
INCOMES	1,921	1,821	1,721	1,621	1,521	1,421	1,321	1,220	1,120	1,020	920	820	720	620	1,582
Investiment Remuneration	1,334	1,234	1,134	1,034	934	834	734	634	534	434	334	234	133	33	(69)
Depreciation Unit	587	587	587	587	587	587	587	587	587	587	587	587	587	587	1,651
(-) Vat taxes	89	85	80	75	71	66	61	57	52	47	43	38	33	29	74
(-) Depriciation Unit	587	587	587	587	587	587	587	587	587	587	587	587	587	587	600
(=) Operating Income	**1,245**	**1,150**	**1,054**	**959**	**863**	**768**	**672**	**577**	**482**	**386**	**291**	**195**	**100**	**5**	**908**
(-) Financial Expense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(=) Profit before income tax	**1,245**	**1,150**	**1,054**	**959**	**863**	**768**	**672**	**577**	**482**	**386**	**291**	**195**	**100**	**5**	**908**
(-) Taxes	423	391	358	326	294	261	229	196	164	131	99	66	34	2	309
(=) Added Net Profit	**1,668**	**1,540**	**1,413**	**1,285**	**1,157**	**1,029**	**901**	**773**	**645**	**518**	**390**	**262**	**134**	**6**	**1,217**

ANALYSIS OF THE 4º MASCARENHAS MACHINE

	23	*24*	*25*	*26*	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*
Especifications	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**	**2037**	**2038**	**2039**	**2040**
NET CASH FLOW (Shareholder)															
Net Profit + Depreciation	2,255	2,127	1,999	1,871	1,743	1,616	1,488	1,360	1,232	1,104	976	848	721	593	1,817
(-) Paid Encharges before the operatio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(-) Amortizations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(=) NCF Addition	**2,255**	**2,127**	**1,999**	**1,871**	**1,743**	**1,616**	**1,488**	**1,360**	**1,232**	**1,104**	**976**	**848**	**721**	**593**	**1,817**
Net Present Value NCF	96	79	65	53	43	35	28	22	17	14	11	8	6	4	11

ANNEX 6

DETAIL OF PHYSICAL LOCATION, INCLUDING INFORMATION ALLOWING THE UNIQUE IDENTIFICATION OF THE PROJECT ACTIVITY

Figure 4. .State of the Espírito Santo (Southeast Brazil)

Figure 5. Municipality of Baixo Guandu, state of the Espírito Santo (South East Brazil)

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Figure 6.Physical location of the hydro plant of Mascarenhas, located within the municipality of Baixo Guandu.

The location for implementation of the project lies approximately 106.81 kilometers from the state capital, the city of Vitória.

Figure 7.Specific physical location of the hydro plant of Mascarenhas, located within the municipality of Baixo Guandu.