CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 01 - in effect as of: 1 July 2004)

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

São João hydro power plant.

Version 01. PDD completed on 30/06/2006.

A.2. Description of the project activity:

With an energy deficit of around 85-90% at the project area, the project activity aims to generate clean energy from hydropower at the *Espírito Santo* state (Southeast of Brazil); an area with a high voltage fluctuation and high transmission losses for the imported energy. Based on a run-of the river scheme with a 7 kilometres penstock entirely in rock, the power plant has an yearly energy of 14.1 MWaverage, the project activity will likely reduce 46,565 tCO_2equ/year while contributing to increase the share of small hydro power generation in the rising thermal power generation scenario in Brazil.

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

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

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

The year 2004 the EPC collapsed and the hydro power plant was put in hold. Several alternative scenarios were considered up to this point, based on the fact that the hydro power plant was partially constructed under such scenario the project developer requested a new EPC. At the end of 2004, the minimum value granted for the EPC was 83.24 MR$ (or + 219% or 45 MR$ of the initial EPC value).Up to this point the incremental cost of the hydro power plant were considered as a prohibitive either for the Brazilian energy standards or for the project developer internal benchmark (as defined in the addicionality check) and the project developer defined a set of investment and trade-off scenarios.

Finally at the end of 2005 the project developer closed the new EPC and the forecasted starting operation is scheduled on January 2007.

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

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

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

A.3. 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. Southeast Brazil.

A.4.1.3. City/Town/Community etc:

Conceição do Castelo

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 *São João* is located on the *Doce* River in the municipality of *Conceição do Castelo*, state of the *Espírito Santo*. The physical coordinates are 20° 30´ 29.140" S and 41° 16´ 50.800" W (more detail available 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).

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

The project activity is placed at the *São João Small Hydro Plant* and it employs water from the *Castelo* River to generate energy, with a small dam of 0.21 km^2 and net head of 259.4 metres. The power station is subterraneous, the only on the *Espírito Santo* State, with 2 horizontal Francis hydraulic turbines with 12.9MW of nominal power each, currently processing an average water flow of 11.20 m^3/s.The synchronous generators have a nominal output of 14.0 MVA and a nominal voltage of 6.9kV each.

The arrangement of the enterprises involves in the same axis the dams and spillway structures. The water is captured on the left margin of the *Castelo River* by a rock-drilled penstock. The energy generated, around 14.1 MW average, will be transported trough a transmission line (96 kV) that connects the power plant to the substation of *Castelo.* The technology for hydro power generation is well known and it has been widely applied in the Brazilian energy sector for the last decades.

***São João* Small Hydro Power**	
Installed capacity	25 MW
Number of gensets	2
Turbines	Francis
Maximum discharge per turbine	5,6 m³/s
Spill lenghts	60,00 m
Reservoir contents	1.950.000 m³
Inundated area	0,21 km²
Hydrographic basin area	552 km²
Lenght of delivery pipe	7.034 m
Waterfall	259,4 m
Voltage	6,9 kV

Table 1. Technical description of the São João small hydro power.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The project activity will physically deliver energy within the project boundary that comprises the South/Southeast-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 %[2] 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) 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[3] 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.

[2] *Brazilian installed capacity. Ministry of Mines and Energy (MME) at its Decennial expansion plan 2006-2015. MME 2006.*
[3] *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[4] value would switch to BM. In this sense, the table 1 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[5], 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 2008). 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 beginning of 2007 (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[6]	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 2. Lead time for construction and operation of new capacity additions, forecasted by the MME, 2006.

The project activity will compete on the energy dispatch with similar capacity factor power plants (i.e. coal combustion turbines). In this case between 2007 and 2009 it applies an OM (100 percent) and for the 2010 to 2012 (end 1st crediting period) it would apply a BM (100 percent) situation. Under such circumstances it is reasonable to define the OM/BM as default value as defined in the ACM0002 baseline methodology for such project activities. Under the above scenario the CDM project activity will reduce an amount of 325,955 tonnes of CO_2equ during the first crediting period.

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

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

Year	Annual estimation of emission reductions in tonnes of CO_2equ
2007	46,565
2008	46,565
2009	46,565
2010	46,565
2011	46,565
2012	46,565
2013	46,565
Total estimated reductions (tCO_2 equ.)	**325,955**
Total number of crediting years	***7***
Annual average over the crediting period of estimated reductions (tonnes of CO_2 equ.)	**46,565**

Table 3. Estimated amount of emission reductions over the chosen crediting period.

A.4.5. Public funding of the project activity:

No public financing for the project activity.

SECTION B. Application of a baseline methodology

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

The approved consolidated baseline 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".

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The project activity has currently a power density of 119 W/m^2 and as stated by the CDM EB[7] can use the approved ACM0002 baseline methodology and the project emissions from the reservoir may be neglected.

B.2. Description of how the methodology is applied in the context of the project activity:

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. For the project activity, regional grid definition is being applied as suggested by the ACM0002 consolidated methodology. The grid boundary definition comprises the South/Southeast-Central West sub-system.

Electricity transfers from external sub-systems (North and Northeast sub-systems) are considered electricity imports and electricity transfers to connected electricity systems are defined as electricity exports.

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.

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[8], 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.

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. For this reason, it is not easy to identify the dispatch and therefore the imports are treated as of an average emission rate of the exporting grid. (*Option c* from the ACM0002).

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* (National electricity

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[7] *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)*

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

agency) database was consulted (see annex 3 for more information). For the project activity the calculations of the OM and BM emissions factor are based on the following data:

- $EFCO_{2,i}$ is obtained from the I*PCC Good Practice Guidance.*
- NCV_i is the net calorific value (energy content) obtained from the country specific values.
- $OXID_i$ is the oxidation factor of the fuel obtained from *1996 Revised IPCC Guidelines.*

Finally, in order to calculate the Build Margin emission factor, the ONS, ANEEL and SIESE (National energy statistics) database was consulted for the operation, generation and fuel consumed of the new power plants.

B.3. 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:

This chapter is constructed based on the document: "Annex 1 – Tool for the demonstration and assessment of addicionality" as defined from the Sixteenth Meeting of the Executive Board.

"Step 0. Preliminary screening based on the starting date of the project activity"

This chapter is constructed based on the document: "Annex 1 – Tool for the demonstration and assessment of addicionality" as defined from the Sixteenth Meeting of the Executive Board.

"Step 0. Preliminary screening based on the starting date of the project activity"

In 1999, *Escelsa* carried out several basic feasibility studies on the river in order to grant further licenses from *ANEEL* to undertake a more complex technical-economical study. In the year 1999 the project developer was granted with the rights to implement the project activity for the selected energy source identified. This standard process was followed by an EPC that in the case of the project activity was contracted in the year 2000 by three companies (*Engevix, Toniolo* and *Impsa*).

After starting construction (2002) and five contract adjustments between the project developer and the EPC group, the mining company delayed gradually the tunnel construction after the rock-drilling phase due to the increasing construction cost uncovered at the initial EPC. Throughout the year 2004, the mining company could not pay off the debts to the outsource construction companies and the power plant construction was halted at the second semester of the year 2004.

Finally in 2005 the civil works retake the construction after the assignation of a new EPC and an investment increase of +250% from the initial price. During this time, *EDP* (Electricity of Portugal), the matrix company of *Energest*, weighted up all the possible investment scenarios and decided to carry out with the power plant construction motivated in part with the potential income from the CDM related income. The *EDP* company has been intensively engaged on the carbon market since 2002, when potential studies and presentations were disseminated to promote the Clean Development Mechanism as a way to make feasible clean energy generation projects on the areas where *EDP* had generation units. The result of these studies was the fact that the CERs would have a definitive impact on the project viability in order to reduce the increasing risk associated to the uncertainties on the regulatory market for energy generation from old utilities.

"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.

Since the first feasibility studies were carried out at the end of 1999 to the expected starting operation time in January 2007, the power plant has suffered from cost adjustments during the years 2002 (start construction), 2003, 2004 and finally 2005, with a total increase on the initial investment of +250%. The initial construction schedule foresaw the implementation of the power plant in 24 moths or equivalently, the project activity would start operations at the end of 2004.

The standard average cost for such power plants in Brazil, based on similar power characteristics and outside of the governmental subsidies of Proinfa is around of U$D 1.2 Million/MW installed[9], where the project activity has a total value of U$D 1.54 Million/MW installed.

Basically for the case of the *PCH São João,* the financial return established by the Brazilian regulation is based on the energy generation, through the return on the investment capital (rentability) defined by the MWh generated, the return on the O&M cost plus sectorial taxes (wheeling fees, connexion cost, etc). Furthermore the energy generated by the power plant will go for a public bid with a maximal price based on the nominal value (VN).

The incremental cost of U$D 20 Millions based on the initial investment cost of U$D 16.5 Millions and the fact that the construction of the power plant delayed more than three years had a definitive impact on the financial equilibrium of the investment. Additionally to the incremental investment cost of the project activity, the cost of the non-energy delivery during three years (278 GWh for the three years), the payment of the installments (12% yearly interest rate) and the lost opportunity cost for three years make the project activity financially unattractive and therefore not at all replicable.

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

The project developer (*Energest-EDP*) had either the possibility to invest on projects with a more attractive return (i.e. energy distribution activities) or to invest on the distribution company at the time of project implementation. In the year 2003, the project developer was more interested on the distribution business due to the increasing opportunities on the energy market for the distribution companies. Since the core business of the company was in the distribution and not on the generation, the project activities on the generation side could compete on resources with similar projects on the distribution side.

Following the collapse of the EPC scheme in 2004, the project developer had the investment alternative of closing the construction works and pay off the debts (cost of raised capital) and the environmental passive occurred during the construction phase.

Sub-step 1b. Enforcement of applicable 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 2b – Option III. Apply benchmark analysis.

The most appropriate financial indicator for this project type (as defined at the *Tool for the demonstration and assessment of addicionality, Sub-step 2b, Option III)* is the Internal Rate of Return (IRR) since it represents the more straightforward and understandable method in capital budgeting and decision context.

[9] *Source:* http://www.unicamp.br/unicamp/unicamp_hoje/ju/julho2004/ju259pag4a.html

The selected benchmark value is defined by the company internal benchmark or WACC representing the expected return on all of a company's securities.

The benchmark here used (weighted average capital cost of the company) 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) plus a country risk linked to the cost of capital. The benchmark used by *Energest* for the year 2005 (at the time of the decision to re-take the construction activities) was of 15% and 14.72% at the year 2003, when the initial EPC was signed out.

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 NTC-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[10], 8.42% in 2005). Moreover, a foreigner investor will consider an increase in the expected return due to the country risk (today estimated around 2.5%-3%[11]). This type of treasury notes has a fixed payment every six months (in the form of interest) for a life spam of 20 years, ideal for medium a long term investments.

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

The following financial indicators for the project activity were defined for the timeline of 2005 when the new EPC was presented within the new investment scenario, based on the following characteristics:

Service		Executed in December 2004
Hydro power dam		98 %
Water intake		80%
Rock-drill based penstock		63%
Power house	Electric infrastructure	0 %
	Civil works	0 %
Control house	Civil works	50%

Table 4. Executed civil works percentage in December 2004.

For the project activity the IRR is calculated based on the new values for the EPC for the year 2004 based on a total investment of R$ 83.84 Millions (USD 36.45 Millions). The financial cost[12] due to the EPC collapse is not included on the IRR analysis. Here below the table with the IRR values with & without the CDM related income.

Unit	IRR Value
IRR for the *PCH São João* power upgrading project without CDM.	10.71 %
IRR for the *PCH São João* power upgrading project with CDM[13]	13.51 %

[10] *Source: http://www.tesouro.fazenda.gov.br/tesouro_direto/download/rentabilidade.pdf*
[11] *Source: EMBI Brazil + JP Morgan index.*
[12] *The cost associated to three years energy non-delivered (278 GWh) and the financial cost (interest rate of 36%) are not included.*
[13] *Initial USD/tCO2equ: 20 Euros.*

Differential (with & without CDM)	2.8 %
Company Internal Benchmark (WACC @ 2005)	15 %
Benchmark (NTC-C, National Treasury Notes @ 2005 [14])	8 % + 8.42 % = 16.42 %

Table 5. 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 January 2007).

The following assumptions were taken in consideration for the analysis:

- An annual average of IGP-M based on 5% (2005).
- The expected energy output is of 92.944 GWh per year. The installed power is estimated on 25 MW and 14.1 MWmed.
- EPC and environmental programs (2% of the total investment).
- Generation fee granted by *ANEEL* on 127 R$/MWh in the year 2005.
- Financial cost (8.52 % from revenues), depreciation and amortization and 4.03% taxes from revenues (sale and use tax).
- 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 cash flow analysis for the project activity with the CDM related income and the project activity financial assumptions are detailed on Annex 3.

Sub-step 2d. Sensitivity analysis.

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 @ 2005)	**15 %**
Energy tariff – Base case: 127 R$ (USD 41.36)[15]	**IRR Value**
IRR for the *PCH São João* power plant	10.71 %
Energy tariff : 130 R$ (USD 42.34)	**IRR Value**
IRR for the *PCH São João* power plant	11.26 %
Energy tariff – Base case: 135 R$ (USD 43.97)	**IRR Value**
IRR for the *PCH São João* power plant	12.2 %
Energy tariff : 140 R$ (USD 45.60)	**IRR Value**
IRR for the *PCH São João* power plant	13.14 %

Table 6. Sensitivity analysis for the variation of the energy tariff. (Source: Single parameters were provided by the project developer).

- Energy generated (Δ +/- 25%):

The return of the investment and the generation cost will be directly affected by the amount of generated energy. The variation on the energy represents a more realistic approach than considering alone the operation cost (which may be in fact internalized by the company). There are mainly two factors affecting the generation cost; the technical O&M cost and the financial cost associated to the project, thus affecting the project cash flow:

Environmental factors such as the hydrological expected flow which would directly affect the amount of energy generated. The ANEEL establishes the calculation parameters to calculate the average energy that the

[14] *Source: http://www.tesouro.fazenda.gov.br/tesouro_direto/estatisticas/historico.asp*
[15] *USD 1 = R$ 3.07 @ 2005.*

power plant will generate and therefore classified under the ANEEL registry. The calculations are based on a minimum period of 30 years, the expected time off that the power plant would be under Operation and Maintenance operations and the generator efficiency. Therefore, the expected energy is likely to be quite unchangeable from the case base.

- The financial perspective of those that commission the projects, (what rate of return is required on the capital, amortization and the length of time over which the capital has to be repaid).

Therefore several possible scenarios are here analyzed.

Company Internal Benchmark (WACC)	**15 %**
MWaverage* (Base Case) : 10.61 *MWaverage	**IRR Value**
IRR for the *PCH São João* power plant (BASE CASE)	10.71 %
MWaverage*: 9.61 *MWaverage	**IRR Value**
IRR for the *PCH São João* power plant	8.6 %
MWaverage* (Base Case) : 11.61 *MWaverage	**IRR Value**
IRR for the *PCH São João* power plant	12.83 %
MWaverage*: 12.61 *MWaverage	**IRR Value**
IRR for the *PCH São João* power plant	14 %

Table 7. 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		10.71 %
IRR value with CDM	8 USD/tCO2equ.	11.78 %
IRR value with CDM	9 USD/tCO2equ.	11.92 %
IRR value with CDM	10 USD/tCO2equ.	12.06 %
IRR value with CDM	11 USD/tCO2equ.	12.20%
IRR value with CDM	12 USD/tCO2equ.	12.34 %
IRR value with CDM	15 USD/tCO2equ.	12.77 %
IRR value with CDM	20 USD/tCO2equ.	13.51 %

Table 8.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) within a realistic price band (linked to the *IGP-M*) and how the generated energy may change 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 energy market regulatory uncertainties (From 2000 to July 2005).

From an 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:

- 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 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 Southeast/Central.

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.

In the year 2003 due to the increasing opportunities on the energy market for the project developer, the core business of the company was in the distribution and not on generation activities, therefore the project activities on the generation side had to compete on resources with similar projects on the distribution side. As a result between 2001 and the second semester of 2003 no new investments on generation units were undertaken. The result of the previous meant that many small and medium hydro power plants were not attractive enough for the investors, which in turn would invest on lower risk project portfolio. As stated here, the project activity had to overcome with the company internal financial barriers (internal benchmark) and the uncertainties due to the new regulation market.

(b) <u>Prevailing Business Practice</u>

Under a likely power shortage on the year 2000, the federal government launched in the beginning of the year of 2000 the Thermoelectric Priority Plan[16] being originally planned 17,500 MW (47 thermo plants) of new thermal capacity by December of 2003, yet at the beginning of 2002 the installed power was reduced to 13,637 MW (40 thermo plants)[17].During the power shortage scenario, the Brazilian government increased drastically the share of the thermal capacity[18] and 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. 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. 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 at the middle of the year 2003.

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

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

[18] *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 %).*

Nowadays the thermal power generation has turned out strategy for the economic development in Brazil, since large reserves of natural gas have been discovered at the *Santos* basin[19]. As consequence of this, the Ministry of Mines and Energy (MME)[20] foresees for decennial period 2006-2015, an increasing share of thermal power plants on the energy matrix[21] based on combined cycle (+297%), coal generation (+300%), Nuclear power generation (+150%) and a decrease on the share of large hydro power plants (-15%).

Under such circumstances, many large pipe networks are being concluded for the next 5 to 10 years (The *GASENE* gas pipeline (Northeast-Southeast) will deliver more than 20 Millions Nm^3 of natural gas per day at the end of 2006) and it is expected to increase the thermal power generation at the near future.

On the other hand, the *Proinfa*[22] was created in 2002 by Law 10.438 with the specific purpose of promoting the use of alternative renewable energy sources (wind, biomass and small-hydro plants) and diversifying the Brazilian energy matrix. In its first phase, the *Proinfa* foresaw the implementation of 3.300 MW of installed capacity, with operations beginning at latest in December 2008. The PPA (power purchase agreement) is secured by *Centrais Elétricas Brasileiras SA – Eletrobrás* – the utility company designated to assist the Brazilian Government in achieving the National Policy's objectives. As stated by Decree 5.025/2004[23], the *Proinfa* was designed not only to increase the participation of alternative renewable energy sources in the Brazilian energy matrix, but also to boost projects in accordance with the legal regime established by the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC), strengthening the Country's engagement in contributing to GHG emission reductions.

As stated before, the project activity is not currently under the Proinfa program. Moreover the fact that the *Proinfa* grants with a energy tariff higher than the one get by the project activity[24] shows how the small power plants need incentives and lower risk investment environment to promote clean and rural energy generation.

The previous shows that such barriers prevented the development of this type of project activity (small hydro power plants development) and alternatively promote the investment on thermal generation sources.

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

As described previously, 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 invest 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.

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

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19 *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.*

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

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

22 *Moreover, the Executive Board also specified that Type E- national and sectorial policies "may not be taken into account in developing a baseline scenario" when such national and sectorial policies have been implemented after the adoption of the CDM M&P in decision 17/CP17 (November 11, 2001). Accordingly, the projects undertaken under the Proinfa program are not considered in the baseline scenario since the program is considered additional.*

23 *Article 5 of Decre*e 5.025, *from March 30, 2004.*

24 *In the year 2005, the PPA based on the Proinfa program was of R$ 132/MWh and R$ 127 /MWh for the project activity.*

There are similar activities other than the project activity observed within the same region/state and operating under similar market conditions and similar technical characteristics (here understood as the regional grid, similar age power plants, rated power, power density and hydro power technology).

Regarding similar activities identified at the project activity region/state under similar technical characteristics (installed power, economic environment, regulations and power density, similar technology) and taking place under similar market characteristics (independent energy producer) the projects identified under such scenario, are the following:

- *UHE Suíça* large hydro power plant.
- *Rio Bonito* small hydro power plant.
- *PCH Aparecida* small hydro power plant.
- *São Domingos* small hydro power plant.
- *PCH Mangaraviti* small hydro power plant.
- *UHE Salto Rio verdinho* large hydro power plant.
- *PCH Rio preto* mini power plant scheme.

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, 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 improve 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 investment and operation 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. - PCH 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.

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 cost where too high[25].

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.

4. - São Domingos small hydro power plant.

The power plant has a rated power of 48 MW or 35.04 MWaverage. It would have a plant efficiency of 73% and will generate a total energy of 306.905 GWh/year. With a total investment cost is of R$ 90 Millions (U$D 42.25 Millions), the IRR of the project is of 9.6%. The project developer did not consider attractive enough to invest in the power plant besides the high plant efficiency.

5. - PCH Mangaraviti small hydro power plant.

Between the year 2002 and 2003 the project developer analyzed the power plant *PCH Mangaraviti.* The hydro power scheme has a rated power of 3 MW with a potential energy generation of 10.655 GWh/year. With a total investment cost is of R$ 4.3 Millions (U$D 2.02 Millions), the IRR of the project is of 13.41%. Under such investment scenario, the project developer did not consider the power plant attractive enough to invest.

6. - UHE Salto Rio verdinho large hydro power plant.

Several feasibility studies were carried out for the large hydro power plant of *Rio verdinho.* With an installed power of 93 MW or 61 MWaverage the total estimated investment was of R$ 90 Millions (U$D 42.25 Millions), the IRR was about 11.23%, clearly below of the internal company benchmark here used (weighted average capital cost of the company) in the year 2002 (14.72%). As a benchmark the company considered the investment as not attractive enough to implement the project activity.

7. - PCH Rio preto mini power plant scheme.

The mini hydro power plant of 770 KW would take advantage of the *Rio preto* river natural characteristics to implement a small scheme hydro power plant with very low environmental impact. The small power plant was analyzed in the year 2004 and further feasibility studies carried out. The total investment value was defined on R$ 2.2 Millions (U$D 1 Million) and the IRR was about 11.26%. Again the project developer did not consider the investment attractive enough to implement the small power plant.

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[25] *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.*

Step 5. Impact of CDM registration

As explained previously in the Step 2, the project activity does not represent an attractive asset to invest and may be understood as not in the business-as-usual scenario in a country where large hydro power plant and thermal fossil fuel projects are preferable.

Despite the fact that the small hydro power generation is a clean source of energy with low environmental impacts and the fact that the project activity reduces the transmission losses of energy from distant states, the registration of the proposed project activity will have a stronger impact on the feasibility of similar projects (type, technology and market) as those ones defined in the *Sub-step 4b*.

As shown at the *Sub-step 4b*, similar project developers may use the CDM related income to overcome the risk associated to the project activity low IRR, thus more important when reducing the high up front cost of the project activity and therefore the necessary capital cost.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

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[26]) 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 (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.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

The baseline study for the project activity was completed on 14/06/2006 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	NO

[26] *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.*

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:

01/01/2007

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

24 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:

01/01/2007

C.2.1.2. Length of the first crediting period:

7 years − 0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Application of a monitoring methodology and plan

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

Approved consolidated monitoring methodology ACM0002; "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources - Version 6".

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

The monitoring methodology ACM0002 is applicable to grid-connected renewable power generation project activities such as electricity capacity additions from hydro power projects with existing reservoirs where the volume of the reservoir is not increased.

The project boundary for the monitoring methodology includes the CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity where the spatial extent is the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

Not applicable. The project emissions (PE_y) from the reservoir are zero as defined by the CDM EB[27] .

D.2.1.1.Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

Not applicable

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Not applicable.

[27] *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)*

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number	Data Type	Data variable	Data unit	Measured, calculated, estimated	Baseline methodology must this element be included?	Recording frequency	Proportion of data to be monitored	How will the data be archived?	Comment
1. EG_y	Electricity quantity	Electricity generation delivered to grid	MWh/Year	Measured	Simple Adjusted OM	Hourly	100%	Electronic and Paper	The electricity delivered to the grid is monitored by the ONS and project developer.
2. EF_y	Emission factor	CO_2 emission factor of the grid	tCO_2/MWh	Calculated	Simple Adjusted OM	Yearly	100%	Electronic and Paper	Calculated as a weighted sum of the OM and BM emission factors.
3. $EF_{OM,y}$	Emission factor	CO_2 Operating Margin emission factor of the grid	tCO_2/MWh	Calculated	Simple Adjusted OM	At the validation	100	Electronic and Paper	Calculated as indicated in the relevant OM baseline method above.
4. $EF_{BM,y}$	Emission factor	CO_2 Build Margin emission factor of the grid	tCO_2/MWh	Measured	BM	Yearly	100%	Electronic	Calculated over recently built power plants defined in the baseline methodology.
5.$F_{i,y}$	Fuel quantity	Amount of each fossil fuel consumed by each power source/ plant	Mass or volume	Measured	Simple Adjusted OM	Yearly	100%	Electronic	Obtained from the ONS (National operator system manager).

6. $COEF_i$	Emission factor coefficient	CO_2 emission coefficient of each fuel type *i*	tCO_2/mass or volume unit	Measured	Simple Adjusted OM	Yearly	100%	Electronic	Plant or country specific values from BEN (National energy balance)
7. $GEN_{j/k/n,y}$	Electricity quantity	Electricity generation of each power source / plant j, k or n	MWh	M	Simple adjusted OM	Yearly	100%	Electronic	Obtained from the ONS (National operator system manager).
8.	Plant name	Identification of power source / plant for the OM	Text	Estimated	Simple Adjusted OM	Yearly	100% of set plants	Electronic	Identification of plants (m) to calculate Operating Margin emission factors
9.	Plant name	Identification of power source / plant for the BM	Text	Estimated	BM	Yearly	100% of set plants	Electronic	Identification of plants (m) to calculate Build Margin emission factors
10. λ_y	Parameter	Fraction of time during which low-cost/must-run sources are on the margin	Number	Calculated	Simple Adjusted OM	Yearly	100%	Electronic	Factor accounting for number of hours per year during which low-cost/must-run sources are on the margin.
11.	Merit Order	The merit order in which power plants are dispatched	Text	Measured	Dispatch Data OM	Yearly	100%	Paper for original documents, else electronic	Required to stack the plants in the dispatch data analysis.
11a. $GEN_{j/k/l1,y\ IMPORTS}$	Electricity quantity	Electricity imports to the project electricity system	kWh	Calculated	Simple Adjusted OM	Yearly	100%	Electronic	Obtained form the latest local statistics. If local statistics are not available, IEA statistics are used to determine imports.

11b. $COEF_{i,j\,y\,IMPORTS}$	Emission factor coefficient	Emission factor from the energy imports	tCO_2/mass or volume unit	Calculated	Simple Adjusted OM	Yearly	100%	Electronic	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

For the baseline determination, project participants shall only account CO_2 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).

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

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

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

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).

$$EF_y = (\omega_{BM} * EF\_BM_y) + (\omega_{OM} * EF\_OM_y) \quad \textbf{Equation 2}$$

Where:

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

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Option 2 is not applicable.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

Not Applicable. .

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not applicable.

D.2.3. Treatment of leakage in the monitoring plan

Not applicable.

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

Not applicable

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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 is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as follows:

$$ER_y = BE_y - PE_y - L_y \quad \textbf{Equation 3}$$

PE_y = The project emissions due to the project activity are equal to zero.

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 installed capacity for the *São João* power plant is of 25 MW where the flooded area is equal to 0.21 km2. The previous figures give a current power density of 119 W/m2, which means that approved methodologies and the project emissions (*PEy*) from the reservoir may be neglected.

L_y = The emissions due to leakage are equal to zero.

D.3. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

(Indicate table and ID number e.g. 3.-1.; 3.2.)	Uncertainty level of data	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D. 2.1.3.1	Low	Data will be monitored and registered by the project developer. Sales invoices will ensure consistency for the collected data.
D. 2.1.3.2	Low	Data does not need to be monitored.
D.2.2.3.3	Low	Data does not need to be monitored.
D.2.2.3.4	Low	Data does not need to be monitored.
D.2.2.3.10	Low	Data does not need to be monitored.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

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 consolidated monitoring methodology ACM0002; "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources - Version 6". 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*[28], or the equipment manufacturer standards.

D.5 Name of person/entity determining the monitoring methodology:

Ecológica Assessoria Ltd (Brazil) is the entity determining the monitoring methodology and not taking part of the project activity as participant.

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

[28] *Brazilian institute for metrology and calibration*

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

Since the project activity comprises only energy generation from renewable sources, the emissions associated to the electricity generation are equal to zero.

E.2. Estimated leakage:

For the project activity the emissions due to leakage (Ly) are equal to zero.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

The leakage and the emissions from the project activity are equal to zero.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

From ACM0002 baseline methodology establishes the baseline emission factor (EF_y) 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.

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*):

$$\mathrm{EF}_{OM,\ Simple\ Adjusted,\ y} = \left(1-\lambda_y\right)\cdot\frac{\sum_{i,j} F_{i,j,y}\cdot \mathrm{COEF}_{i,j}}{\sum_{j}\mathrm{GEN}_{j,y}} + \lambda_y\cdot\frac{\sum_{i,k}\mathrm{F}_{i,k,y}\cdot\mathrm{COEF}_{i.k}}{\sum_{k}\mathrm{GEN}_{k,y}}$$ ***Equation 4***

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_2equ 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 resources for the project activity are thermal power plants burning coal, fuel oil, natural gas and diesel oil. These plants result in non-balanced emissions of greenhouse gases calculated as follows:

The 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.

- **STEP 2.** Calculate the Build Margin emission factor ($EFBM_{,y}$) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*.

For the project activity, the *Option 2* from the ACM0002 baseline methodology is applied. For the first crediting period, the Build Margin emission factor $EFBM_y$ must be updated annually *ex-post* for the year in which actual project generation and associated emissions reductions occur.

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*.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The emission reduction *ERy* by the project activity during a given year *y* is the difference between baseline emissions (BE_y), project emissions (PE_y), as follows:

$ER_y = BE_y - PE_y - Ly$	***Equation 5***

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

Finally, 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 6***

E.6. Table providing values obtained when applying formulae above:

Table	Calculated Results	Comments	Source
A1	$EF\_OM_y = 0.626$	EF_OM_y was calculated	ONS, Operation and Energy Generation:

	(tCO_2equ/MWh)	for all the thermal plants within the project boundary	(http://www.ons.org.br/historico/geracao_energia.aspx) Fuel Energy Content: *BEN* (National Brazilian report on energy generation) Fuel Carbon Content: Revised IPCC Guidelines for National Greenhouse gas Inventories, Workbook p.1.6 Fuel Oxidation Factor: Revised IPCC Guidelines for National Greenhouse gas Inventories, Workbook p.1.8 Fuel consumed at the power generation: SIESE 2002, 2003, 2004. (National Energy statistics). Installed capacity: *ANEEL* www.aneel.gov.br
A2	EF_BM_y = 0.13 (tCO_2equ/MWh)	EF_BMy was calculated for a sample group *m* consists of the five power plants that have been built most recently and actually on operation.	Power Plant energy generation: *CCEE* (Monthly Energy Generation). Power Plant capacity factors (default): OECD and IEA Information Paper, *Bossi et al* (2002). Fuel Energy Content: *BEN* (National Brazilian report on energy generation) Fuel Carbon Content: Revised IPCC Guidelines for National Greenhouse gas Inventories, Workbook p.1.6 Fuel Oxidation Factor: Revised IPCC Guidelines for National Greenhouse gas Inventories, Workbook p. 1.8 Installed capacity: *ANEEL* www.aneel.gov.br
A3	*EF* =0.377 (tCO_2equ/MWh)	The baseline emission factor (EF_y) is calculated as the weighted average of the combination of operating margin (*OM*) and build margin (*BM*) factors	

SECTION F. Environmental impacts

F.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.

*ESCELS*A obtained authorization from *ANEEL* by means of *ANEEL* Resolution n. 110 of May 18, 1999, which was subsequently transferred to the undertaking *Castelo* S.A. through *ANEEL* Resolution n. 496 18th of October of 2000.

Until the moment, *PCH São João* has all environmental licenses required by law. The *LAI* was emitted in 1999 registered under the number 043/98, renewed in June 17, 2005 by the *IEMA* (Environmental and Water Resources State Institute), under n. 180/05, valid for four years.

The environmental impacts of the Project are considered small by the national definition of small hydro power plants (*PCHs*). By the *ANEEL* legal definition, Resolution n. 652 December 9, 2003, *PCH* is a power plant with installed capacity between 1 MW and 30 MW, with a reservoir area less or equal to 3 km^2. In general, consists in a run-of-river power plant, which results in environmental impacts with very low intensity, as in the case of *PCH São João.*

Between other factors, the building of small power plants increases the fraction of renewable energy sources in Brazilian energy matrix and therefore contributes to environmental sustainability.

As stated above, the environmental license acts preventing damages against the environment, due to difficult or impossible restoring. 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 of the World Commission on Dams (WCD):

i) Gaining public acceptance

The public acceptance of fundamental decisions is essential for the equitable and sustainable development of hydraulic and energy resources. The acceptance emerges when the rights are recognized, the risks are admitted and stipulated, and the prerogatives of the entire population affected are protected. There was no displacement of the local inhabitants to the building of the dam, thus their native rights were respected.

On the other hand, including in the environmental license steps in Brazil, defined by the Article 10 of Resolution 237/97, is the fulfilment of a public audience, when required. There was no objecting regarding the PCH São João implementation in the public audience.

ii) Comprehensive options assessment and addressing existing dams

At the national scenario with the tendency of thermal power plants implementation, which would unleash a rising in GHG emissions, and several building projects of hydro power plant in the Amazonic region, with the construction of large dams with high potential to cause intense environmental impacts, the building of *PCH São João* is a positive alternative in the environmental viewpoint. It can be justified due to the fact that, as discussed previously, the implementation of small power plants increases the sharing of renewable energy sources in the Brazilian energy matrix in order to contribute to environmental sustainability.

iii) Sustaining rivers and livelihoods

Rivers, basins e aquatic ecosystems are the biologic motors of the planet and the sustenance of local community. The *PCH São João* is being built in a way that contributes to the ecosystems integrity and to the sustenance of the local community. It is designed, modified and operated following this precept. In order to execute the project activity, all options to avoid significant impacts in the environment, especially aquatic species was evaluated. In cases which were not possible to avoid impacts, some mitigation measures were carried out increasing the environmental sustainability. The *PCH São João* does not affect the local population, since the local economy is based on coffee farming.

iv) Recognizing entitlements and sharing benefits

According to the World Commission Dams report, negotiations with the population affected by the dam shall be performed, in a way that their acquired rights of sustenance and life quality are recognized and their benefits from the projects are guaranteed. Despite the fact there was no displacement of people due to project activity building, some benefits were generated such as creation of jobs and local work force employment which contribute to local economy.

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 water resources policy shall establish specific provisions to accordance regarding sharing hydrographic basin use. In Brazil, it was established the National System of Hydrographic Resources Management, which one of its important pieces are Hydrographic Basin Committees . These Committees are composed by public representatives, water users and society organizations related to water resources. The aim of the Basin Committees is the decentralized and participative management of the local water resources, by implementing technical instruments of management, dealing the conflicts and promoting multiples water use. They also shall respect the water domain, integrate all Government actions, provide respect to the native ecosystems, promote the conservation and recovery of watercourses and guarantee the reasonable and sustainable use of water resources.

The *Castelo* River is a river inside the geographic limits of *Espírito Santo* State and belongs to the *Consóricio Intermunicipal da Bacia Hidrográfica do Rio Castelo* (local Basin Consortium), which was properly communicated on the environmental license.

The *PCH São João* provides relevant features of local and regional insertion. Thus, the use of the river by the project activity does not discontinue the activities of substance development of the region and contributes on the local integration to generation and distribution of energy.

F.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. Until the moment *PCH São João* has all environmental licenses required by law. The *LAI* was emitted in 1999 registered under the number 043/98, renewed in June 17, 2005 bye the *IEMA* (Environmental and Water Resources State Institute), under n. 180/05, valid for four years, as well the authorization emitted by *ANEEL* Resolution n. 110 of May 18, 1999, which was subsequently transferred to the undertaking *Castelo* S.A. through *ANEEL* Resolution n. 496 October 18, 2000.

SECTION G. Stakeholders' comments

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

According to the Resolution number 1 of the Brazilian Inter-Ministerial commission on Climate Change[29], 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 9, below) describing the major aspects of the implementation and operation of the proposed project.

[29] *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
Castelo City Hall	Public	103, *Nossa Senhora da Penha* Avenue, 103 *Castelo, Espírito Santo*, ZIP Code 29360-000	(28) 3542 8526/ 2124	*Cleone Gomes do Nascimento*	--
Câmara dos Vereadores de Castelo	Public	118, *Getulio Vargas* Street, *Castelo, Espírito Santo*, ZIP Code: 29360-000	(28) - 35421011	--	--
City Council of *Vitória*	*Public*	*Mal. Mascarenhas de Moraes Street*, nº 1788 ZIP code: 29052-120.	(27) 3334-4626	*Alexandre Passos*	--
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
Environment State Institute	Public	Km 0, BR 262 Road, *Cariacica, Espírito Santo*, ZIP Code; 29140-500	(27) 3136 3434/ 3136 3436	*Sueli Passoni Tonini*	--
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*	--
Instituto 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
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
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
Public Ministry of *Vitória*	Public	350 *Humberto Martins de Paula* Street, *Vitória, Espírito Santo*, ZIP Code: 29050-265.	(27) 3224 4500	--	--

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
Consórcio Intermunicipal da Bacia Hidrográfica do Rio Castelo (Basin Consortium of *Castelo* River)		103, *Nossa Senhora da Penha* Avenue ,*Castelo, Espírito Santo*. ZIP CODE: 29360-000	(31) 3542-2211	Pres.: Abílio Correia de Lima	castelopmc@escelsa.com.br
Castelo College	Public	58, *Luiz Ceotto* Street, *Castelo-ES*	(28) 3542-2253		diretoria.facastelo@terra.com.br
Commercial Industrial Association of Castelo		71, *Aristeu Borges de Aguiar* Street, *Castelo, Espírito Santo*	(28) 3542-3742		
Conceição do Castelo City Hall	Public	426, *José Grilo* Avenue, 426, *Conceição do Castelo - ES*. ZIP Code: 29.370-000	(28) 3547 1102	Mayor Francisco Saulo Belisário	pmcc@ig.com.br
Agriculture and Environment Municipal Secretary of *Castelo*	NGO	219, *Joaquim Cornélio Filho* Avenue	(28) 3547-1962/1245		
Emílio Nemer de Castelo State High School	Public	126, *Bernardino Monteiro* Street - *Castelo – ES* – ZIP Code: 29360-000	(28) 3542-1284	Dir. Ana Maria Vieira Callegari	escolacetec@yahoo.com.br escolacetec@bol.com.br
João Bley School	Public	694, *Machado Assis* Street – *Santo Anderezinho – Castelo – ES* – ZIP Code: 29360-000	(28) 3542-1413	Dir. Eliene Preduzi Cogo	joaobley_castelo@yahoo.com.br
Eliza Paiva Municipal School	Public	348, *José Grilo* Street – *Centro – Conceição do Castelo – ES* – ZIP Code: 29370-000	(28) 3547-1382	Dir. Sebastião Thvoline	-
Professora Aldy Soares Mercon Vargar School	Public	9, *Praça da Matriz – Centro – Conceição do Castelo – ES* – ZIP Code: 29370-000	(28) 3547-1283	Dir. Maria Belizares Spadeto	-

Rural Worker's Trade Union of Castelo	NGO	327, *Glorinha Nemer* Street– *Castelo – ES* – ZIP Code: 29360-000	(28) 3542-0015/2340	Dir. José César Augustin	str.castelo@yahoo.com.br
Agrarian Cooperative of Castelo LTD.	NGO	35, *Antônio Machado* Street – *Centro – Castelo – ES* – ZIP Code: 29360-000	(28) 3542-1387/0014	Dir. Domingos João Piassi	coop.cacal@terra.com.br
Commercial and Industrial Association of Castelo		75, *Aristeu Borges Aguiar* Street – *Centro – Castelo – ES* – ZIP Code: 29360-000	(28) 3542 – 2358	Pres. Luciano Travaglia	acicast@terra.com.br
Farming and Florest Defense Institute	NGO	396, *NS Penha* Avenue – *Centro – Castelo – ES* – ZIP Code: 29360-000	(28) 3542-2771		
Rural Trade Union of Castelo	Public	386, *NS Penha* Avenue – *Centro – Castelo – ES* – ZIP Code: 29360-000	(28) 3542-1673		
Coffee Farming Association of South of Espírito Santo State	NGO	35, *Antônio Machado* Street - *Castelo – ES* – ZIP Code: 29360-000			
Commercial and Industrial Association of Conceição do Castelo	NGO	219, *Joaquim Cornélio Filho* Street – *Conceição do Castelo – ES* – ZIP Code: 29370-000	(28) 3547-1212		
Rural Worker's Trade Union of Conceição do Castelo	NGO	93, *José Souza Pinto* Street , *Conceição do Castelo – ES* – ZIP Code: 29370-000	(28) 3547-1323		
Rural Trade Union of Conceição do Castelo		*Joaquim Cornélio Filho* Street, *Conceição do Castelo – ES*. ZIP Code: 29370-000	(28) 3547-1261		

Table 9. Participant entities

G.2. Summary of the comments received:

To date, no comments have been received.

G.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:	Engineer
Salutation:	Mr
Last Name:	Sirgado
Middle Name:	Miguel
First Name:	Pedro
Department:	Environment and Sustainability
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.

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Annex 3

BASELINE INFORMATION

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.

Especification	Description	1	2	3	4	5	6	7	8	9	10	11	12
INVESTMENT FLOW													
Initial investment		(10,915)	(25,468)	0	0	0	0						
Initial investment VP		(39,399)											
(=)OPERATIONAL FLOW	**EBITDA**	0	0	5,045	5,045	5,045	5,045	5,045	5,045	5,045	5,045	5,045	5,045
(+) Service result	**EBIT**	0	0	3,210	3,210	3,210	3,210	3,210	3,210	3,210	3,210	3,210	3,210
(+) Depreciation	**DEPR**	0	0	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835
(+) Residual Value (cash balance)													
FINANCIAL FLOW													
Financial VP	**70.00%**	27,579											
(=) Financial instalments (J+A)	**Pfi**	0	0	(3,768)	(3,640)	(3,512)	(3,384)	(3,255)	(3,127)	(2,999)	(2,870)	(2,742)	(2,614)
(+) Interests (J)	**J**	0	0	(2,263)	(2,135)	(2,006)	(1,878)	(1,750)	(1,621)	(1,493)	(1,365)	(1,237)	(1,109)
(+) Amortization (A)	**1**	0	0	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)
TAX EFFECTS													
Income tax - CSSL	**IR-CSSL**	0	0	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)
FREE CASH FLOW	*FCL*	(11,820)	0	1,137	1,265	1,394	1,522	1,650	1,779	1,907	2,035	2,163	2,291
NET PRESENT VALUE (NPV)	***8.44%***	**US$ 8,368**	Calculated based in a lifetime of 22 years										
INTERNAL RATE OF RETURN	***IRR***	**13.51%**	Calculated based in a lifetime of 22 years										
REQUIRED REFINANCING	***REF***	**65.00%**											

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Especification	Description	13	14	15	16	17	18	19	20	21	22	23	24
INVESTMENT FLOW													
Initial investment													
Initial investment VP													
(=)OPERATIONAL FLOW	**EBITDA**	4,335	4,335	4,335	4,335	4,335	4,335	4,335	4,335	4,335	4,335	4,326	20,495
(+) Service result	**EBIT**	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,755	4,268
(+) Depreciation	**DEPR**	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,835	1,571	0
(+) Residual Value (cash balance)													16,227
FINANCIAL FLOW													
Financial VP	**70.00%**												
(=) Financial installments (J+A)	**Pfi**	(2,486)	(2,357)	(2,229)	(2,101)	(1,972)	(1,844)	(1,716)	(1,588)	(224)	0	0	0
(+) Interests (J)	**J**	(980)	(852)	(724)	(595)	(467)	(339)	(211)	(82)	(9)	0	0	0
(+) Amortization (A)	**1**	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(1,505)	(215)	0	0	0
TAX EFFECTS													
Income tax - CSSL	**IR-CSSL**	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)	(140)
FREE CASH FLOW	*FCL*	1,710	1,838	1,966	2,095	2,223	2,351	2,479	2,608	3,971	4,195	4,186	20,356

Table 10. Financial cash flow analysis.

PCH São João

Energy Characteristics	
Installed Capacity (MW)	25
Energy (MWh average)	10.61
Availability Factor	100.00%
Energy increase	0.00%
Energy (MWh)	92,944

Energy Cost	
Rate for sales (mix of energy purchasing prices)	52.26

Energy Transport Charges	
Tariff for transportation	0.48
- Rate for distribution	0.97
- Connection fee	0.00

Hydro Power Lifetime	
Hydro Power lifetime (years	24

Investiment Description	
- Administration staff	1,160
- EPC	34,495
- Others	0
- Facilities	0
- Environment	728
Fluctuation value from the initial investment	725.926
- Unitary cost (in US$/ Installed kW)	
Value - all in cost	1,455
EPC (calculated)	34,495

Interest During Construction	
Own capital (Minimum value)	12.00%
Third Market Capital (Maximum value)	0.00%

Amortization	
Method	Constant
Period (years)	6
Grace period (years)	2

Refinancing	
Required percentage	65.00%

OPERATION	
Number of months of operation in the first year	12

Legal Charges	
ICMS	
- ICMS on electric energy (in %)	0.00%
Taxes on invoiced revenues	**3.65%**
- PIS (in %)	0.65%
- COFINS (in %)	3.00%
CPMF (in %)	**0.38%**
Taxes on real revenues	**no**
- Income tax (in %)	25.00%
- Social contribution without revenues (in %)	9.00%
Taxes on revenues - Income tax presumed	8.00%
- Income tax --- 8% of revenues	15.00% 10.00%
Taxes on revenues - Social contribution on net profits presumed	12.00%
- Social contribution without revenues --- 12% of revenues	9.00%
Finantial compensation =%*Cap*RCD (in US$)	**0**
- Reference Currently Duty - RCD (in US$)	0.00
- Applied Percentual	0.00%
ANEEL inspection taxes = 0.50% of revenues	**0.50%**

OPERATIONAL COSTS	
O&M costs (in US$/MWh)	6.00
Security costs - Technic/Operational (in US$/ MWh)	0.05%

OTHER EXPENSES	
Administration - SNUC	0.00%
Area renting	0.00%
Success rate	0.00%

FINANTIAL CHARGES	
Financial tax (in % ao ano)	8.52%
Working capital financial tax (in % per year)	0.00%
Investments taxes (in % per year)	0.00%
Exchange tax (R$/US$)	2.43
Exchange tax R$/Euro)	2.90

WEIGHTED AVERAGE COST OF CAPITAL (WACC)	
Weighted average cost of capital	8.44%
Investment appreciation	13.00%

DEPRECIATION	
Equipments	5.00%
Civil Works	4.00%
Annual Depreciation (average)	4.80%

PAYMENT SCHEDULE	
Year 1	30.00%
Year 2	70.00%
Year 3	0.00%
Year 4	0.00%
Year 5	0.00%
Year 6	0.00%
Annual distribution of the investment	100.00%

RESULTS	
NPV US$ x 10^3)	8,368.10
IRR (%)	13.51%
ROE (%) - Annual average	10.15%
ROA (%) - Annual average	5.68%
EBITDA / Inv. (%) - Annual average	11.35%
MARGIN OF PROFIT - Annual average	2.31%
ROIC (%) - Annual average	4.57%

EQUIVALENT ANNUAL COST (R$/MWh)		
Description	R$/MWh	US$/MWh
Total cost with taxes and rates =	176.49	70.60
Total cost without taxes and rates =	101.97	40.79
Total cost without taxes and rates without depreciation=	139.39	55.76
O&M =	5.10	2.04
Tranport =	3.23	1.29
Others (Administration, Renting, Success rate, Safety) =	0.40	0.16
Taxes =	6.12	2.45
ANEEL rates=	0.54	0.22
Own Capital =	29.08	11.63
Third Market Capital =	67.86	27.14
Depreciation =	37.10	14.84
Financial charges =	27.46	10.98

Table 11. Financial premises for the project activity.

Below, the graphs representing the duration load curve and the energy demand for 2002, 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).

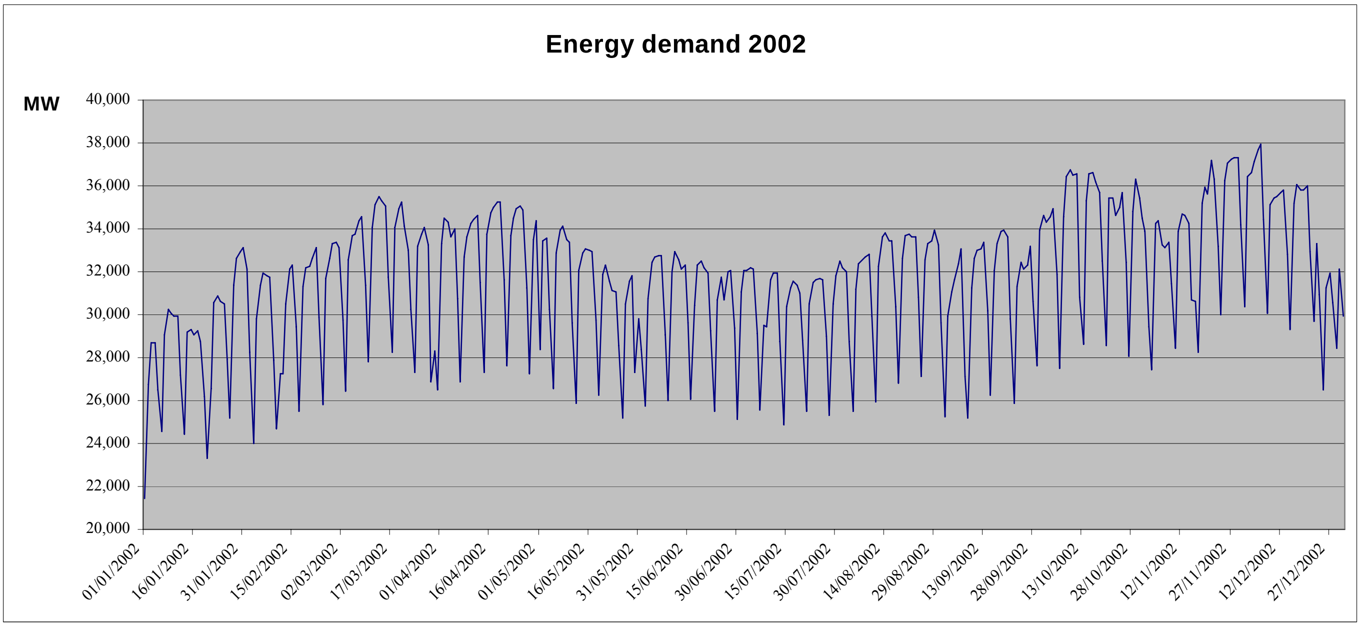

Figure 1. Energy demand 2002 for the South – Southeast – Central west system.

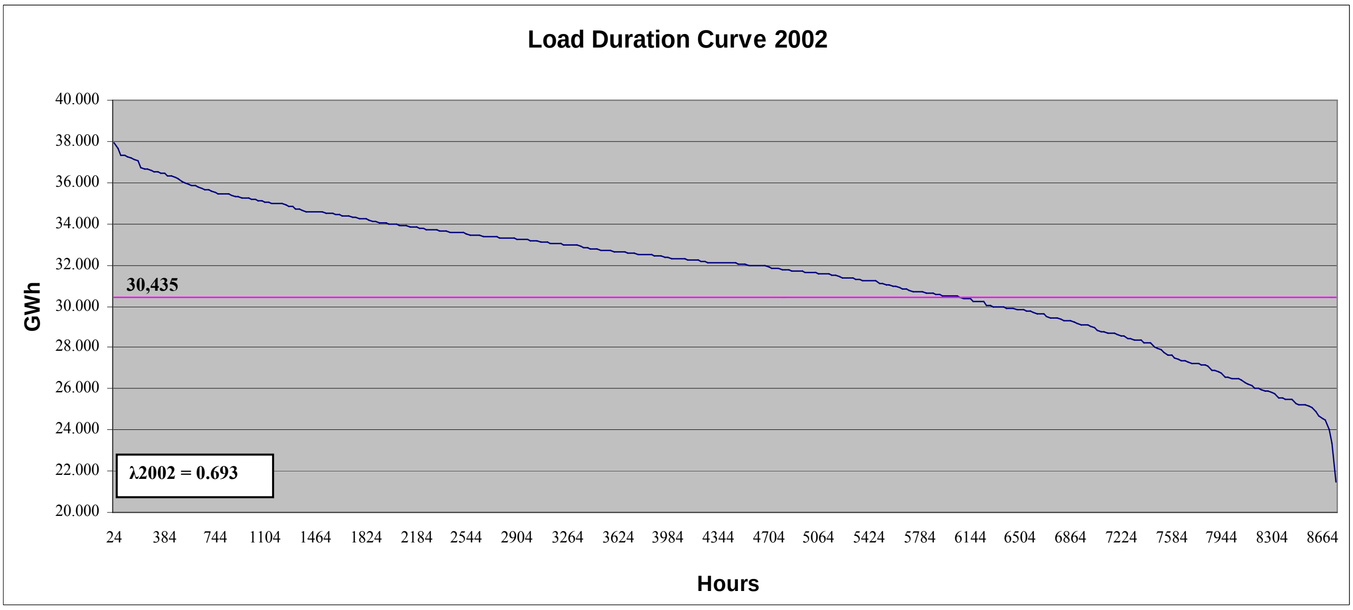

Figure 2. Load duration curve 2002 for the South – Southeast – Central west system

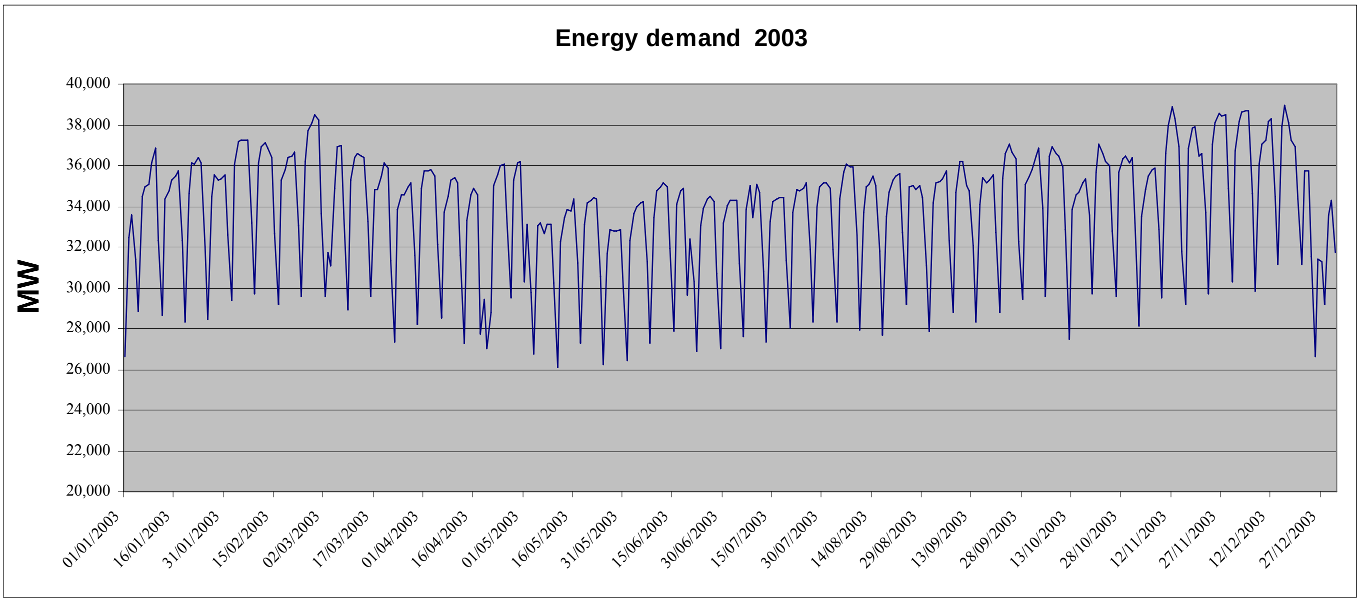

Figure 3. Energy demand 2003 for the South – Southeast – Central west system

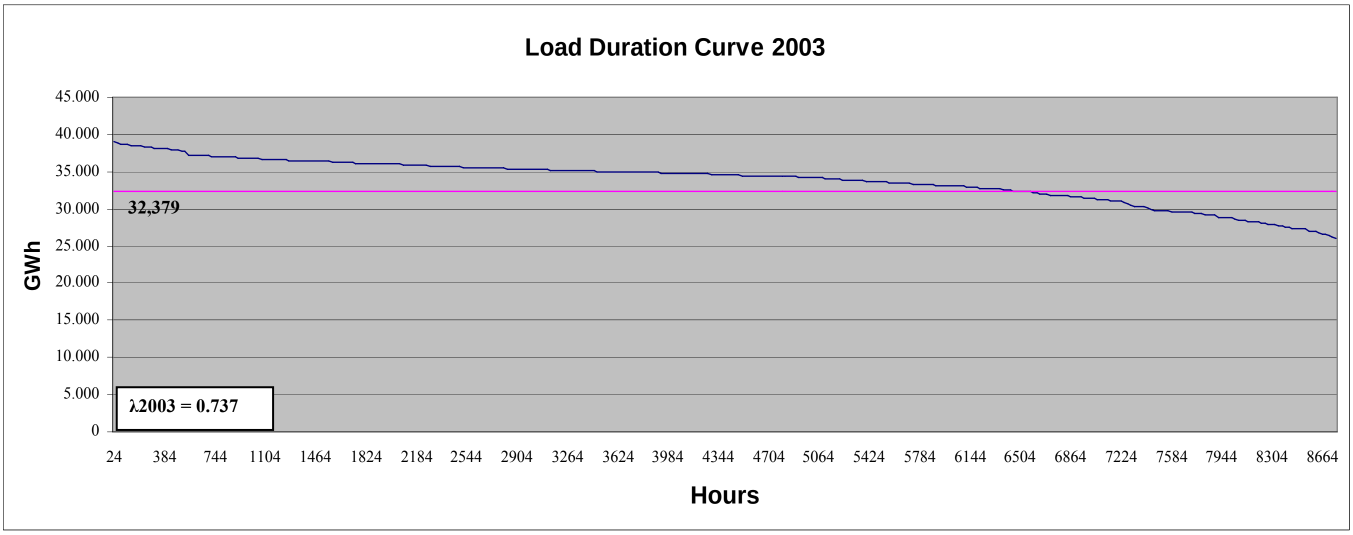

Figure 4. Load duration curve 2003 for the South – Southeast – Central west system

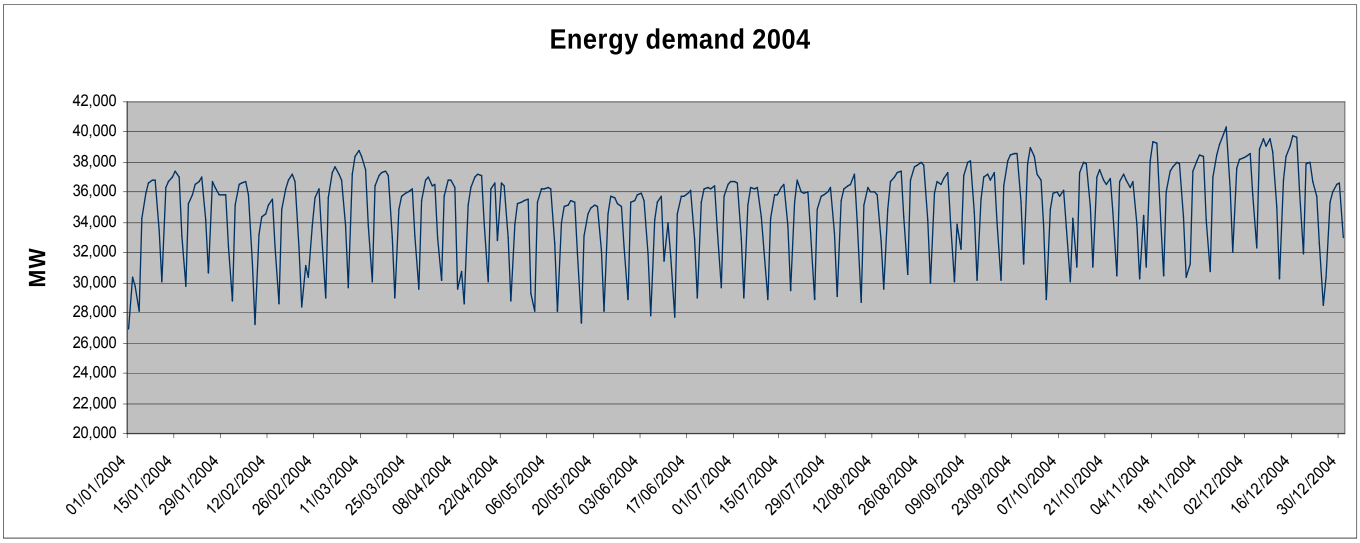

Figure 5. Energy demand 2004 for the South – Southeast – Central west system

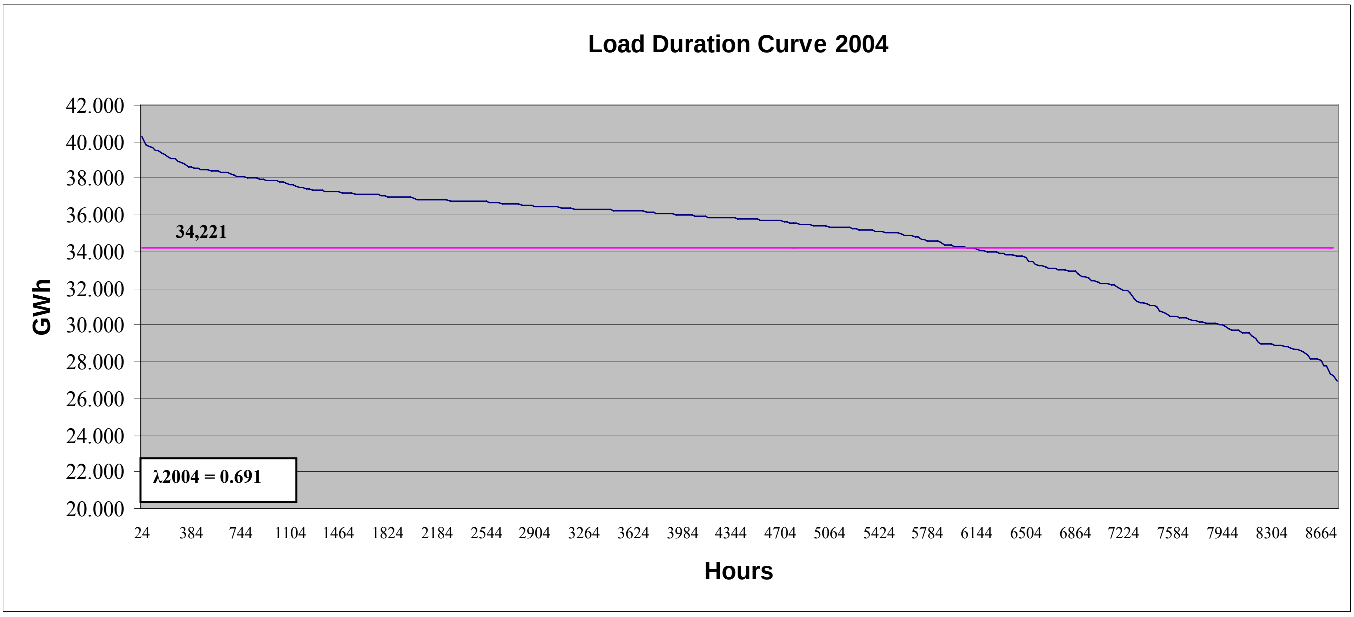

Figure 6. Load duration curve 2004 for the South – Southeast – Central west system

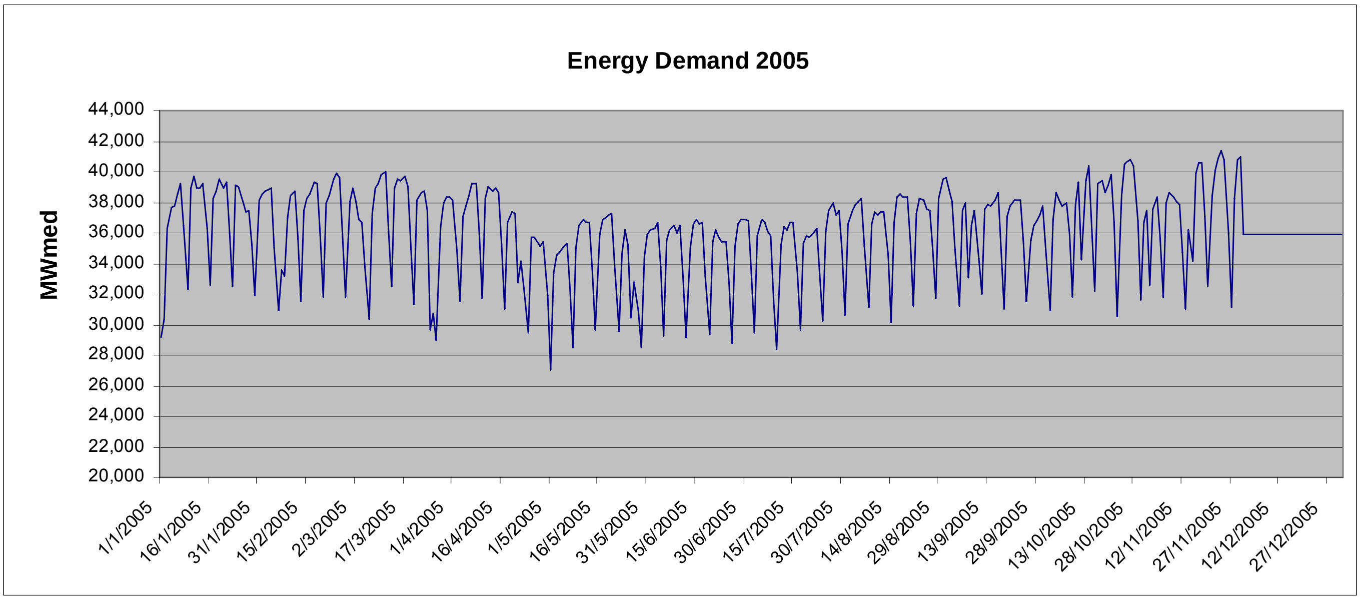

Figure 7. Energy demand 2005 for the South – Southeast – Central west system

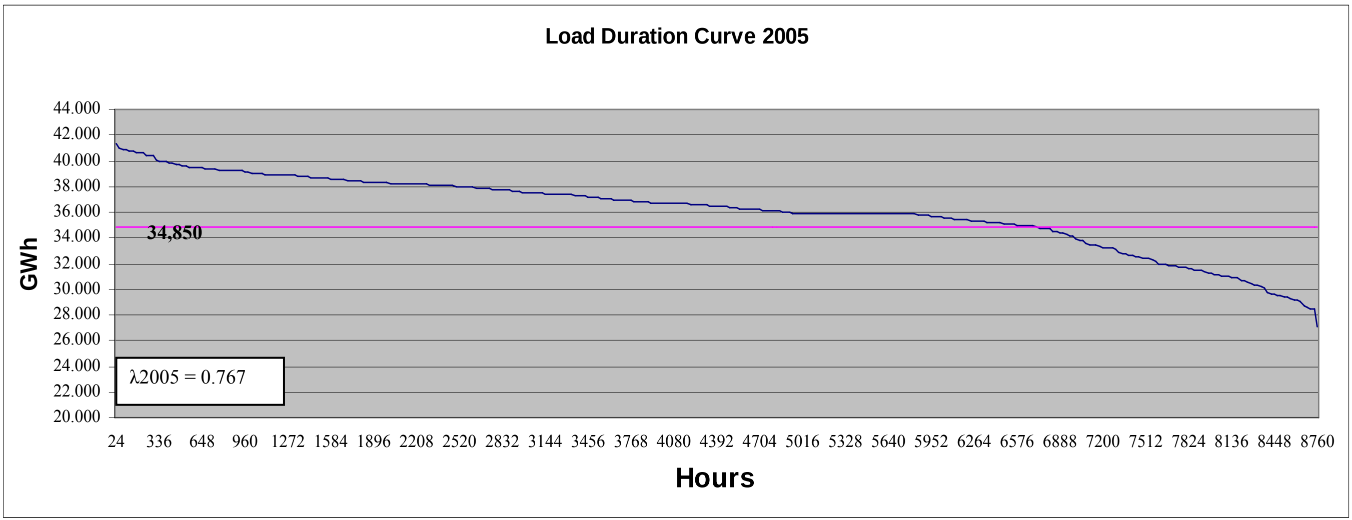

Figure 8. Load duration curve 2005 for the South – Southeast – Central west system

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 12. ***Lead time estimation for electric generating technologies***.[30]

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
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

30 *Source: OECD/IEA report: Projected Cost of Generating Electricity*

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 -	26,000	26,000	26,000

		MT			
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 13. ***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 14. *Installed capacity of the thermal power plants*

Annex 4

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). Please refer to the D.2.1.3 for more information.

The monitoring of the *PCH São João* Hydro Power Plant will be based on an internal control and sampling unit that will execute the operation routines, pre-synchronization and final synchronization of the two gensets 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 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.

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”.

3. QA/QC procedures (Data consistency)

The planning procedures are set to ensure consistency on the monitoring equipment and sensors (Quality control) and the data collected (Quality assurance). No special procedures are defined here for the monitored data since the majority of the data (D. 2.1.3.2 to D.2.2.3.10) do not need to be monitored.

Data vintage	Uncertainty	QA/QC procedures
D. 2.1.3.1	Low	Data will be monitored and registered by the project developer. Sales invoices will ensure consistency for the collected data.
D. 2.1.3.2	Low	Data does not need to be monitored.
D.2.2.3.3	Low	Data does not need to be monitored.
D.2.2.3.4	Low	Data does not need to be monitored.
D.2.2.3.10	Low	Data does not need to be monitored.

Annex 5

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

Figure 9. Detail of physical location. (Source: IBGE 2005)

Figure 10. Detail of Conceição do Castelo municipality.