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

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Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Revision history of this project

Version Number	Date	Description and reason of revision
1	31/03/09	Version of PDD of initial adoption
2	30/10/09	Review according to validation report
3	04/02/10	Review according to DNA letter
4	07/06/12	Revision of the approved methodology version
5	11/10/12	Review according to UNFCCC requests

Project title: Electric Power generation from renewable sources – Barra da Paciência, Ninho da Águia, Corrente Grande, Paiol, São Gonçalo and Várzea Alegre Small Hydropower Plants.
Version 05
Date: 11/10/2012

A.2. Description of the project activity:

Empresa de Investimento em Energias Renováveis S.A.("ERSA") is a corporation whose main objective is exploring opportunities into the Brazilian power generation market from renewable sources, by means of a small and medium plant portfolio. To meet its goal, ERSA invests in the construction and acquisition of Small Hydropower Plants (SHP), biomass power plants and wind power plants.

ERSA is engaged in the development and implementation of a relevant environmental and social management system, in conformity with the international and local standards. From this perspective, ERSA will also ensure the fulfillment to IFC performance standards and all the relevant and applicable Brazilian laws and regulations regarding social and environmental issues. Among ERSA's shareholders are companies whose main purpose is the sustainable development and emission reductions, such as DEG, a branch of the German bank KFW.

Nowadays, ERSA has 20 projects to explore hydroelectric potentials totaling 312.5 MW of installed capacity.

The project activity referred to in this document is the construction of six SHPs, including the following Small Hydropower Plants (Pequena Central Hidrelétrica – PCH in Portuguese):

- **Barra da Paciência SHP:** it is located in the cities of Gonzaga and Açucena, Minas Gerais. Barra da Paciência SHP is legally represented by SPE Barra da Paciência Energia S.A., being 100% of its shares owned by ERSA. It has 23 MW[1] of installed capacity and uses the hydraulic potential of Corrente Grande River.

[1] The installed capacity of the Barra da Paciência SHP can be evidenced by the ANEEL's (*Agência Nacional de Energia Elétrica* - National Energy Agency) Resolution that authorizes the installed capacity of 23 MW to this power plant (reference: BarraPaciencia_ResolutionANEEL-3718_20101206).

The Corrente Grande River is part of the Rio Doce Basin, located in the Central East Region of Minas Gerais State, being a tributary by the left margin of Doce River. SHP is located 68 km from the river's mouth. The project will demand a reservoir area with a maximum of 0.52 km^2, with a power density of 44.23 MW/km^2.

The generation potential study focused on an area known as "Grande Alça do Rio Corrente Grande", impacting areas between the Gonzaga and Açucena cities. The geographic coordinates of the project activity are 18º57'00" S and 42º36'00" W.

Location of Barra da Paciência SHP

Figure 1: Location map
(Source: Environmental Impact Assessment Study - EIA of SHP)

- **Ninho da Águia SHP:** it is located in the city of Delfim Moreira, Minas Gerais. Ninho da Águia SHP is legally represented by SPE Ninho da Águia Energia S.A., being 100% of its shares owned by ERSA.

It has 10MW[2] of installed capacity and uses the hydraulic potential of Santo Antônio River. SHP is located 6 km from the river's mouth. The project will demand a reservoir area with a maximum of 0.017km^2, with a power density of 588.24 MW/km^2. The geographic coordinates of project activity are 22°30' S and 45°20' W.

[2] The installed capacity of the Ninho da Águia SHP can be evidenced by the ANEEL's (*Agência Nacional de Energia Elétrica* - National Energy Agency) Resolution that authorizes the installed capacity of 10 MW to this power plant (reference: NinhoAguia_ResolutionANEEL-1909_20100705).

Location of Ninho da Águia SHP

Figure 2: Location map
(Source: Environmental Impact Assessment Study - EIA of SHP)

- **Corrente Grande SHP:** it is located in the cities of Gonzaga and Açucena, Minas Gerais. Corrente Grande SHP is legally represented by SPE Corrente Grande Energia S.A, being 100% of its shares owned by ERSA. It has 14MW[3] of installed capacity and uses the hydraulic potential of Corrente Grande River.

  The Corrente Grande River is part of the Rio Doce Basin, located in the Central East Region of Minas Gerais State, being a tributary by the left margin of Doce River. SHP is located 75 km from the river's mouth. The project will demand a reservoir area with a maximum of 0,98 km^2, with a power density of 14.3 MW/km^2.

  The generation potential study focused on an area known as "Médio Doce Superior", impacting areas between the cities of Governador Valadares e Ipatinga. The geographic coordinates of the project activity are 18°52'00"S and 42°31'00"W.

[3] The installed capacity of the Corrente Grande SHP can be evidenced by the ANEEL's (*Agência Nacional de Energia Elétrica* - National Energy Agency) Resolution that authorizes the installed capacity of 14 MW to this power plant (reference: CorrenteGrande_ResolutionANEEL-1202_20080115).

Location of Corrente Grande SHP

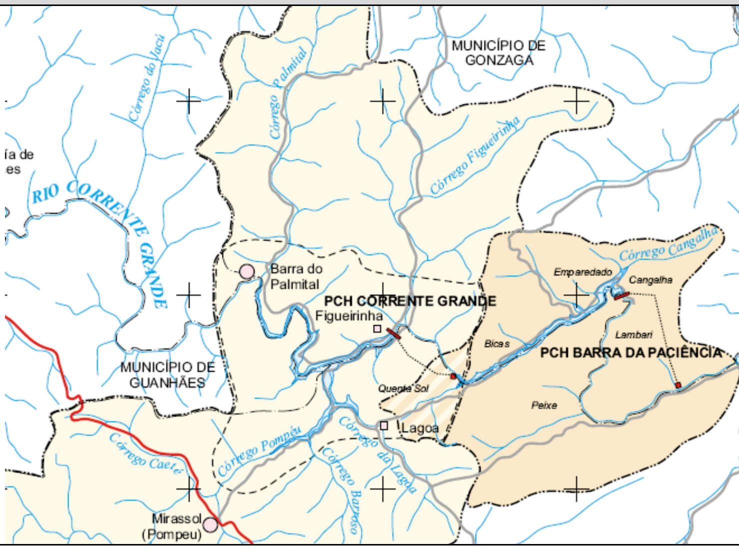


Figure 3: Location map
(Source: Environmental Impact Assessment Study - EIA of SHP)

- **Paiol SHP:** it is located in the cities of Frei Inocêncio and Matias Lobato, Minas Gerais. Paiol SHP is legally represented by SPE Paiol Energia S.A., being 100% of its shares owned by ERSA. It has 20 MW[4] of installed capacity and uses the hydraulic potential of Suaçuí Grande River.

  The Suaçuí River is part of the Rio Doce Basin, located in the Central East Region of Minas Gerais State, being a tributary by the left margin of Doce River. SHP is located 54 km from the river's mouth. The project will demand a reservoir area with a maximum of 0.65 km^2, with a power density of 30.8 MW/km^2.

  The generation potential study focused on an area between the cities of Frei Inocêncio and Mathias Lobato, where the project will be installed. The geographic coordinates of the project activity are 18°34'S and 41°51'W.

[4] The installed capacity of the Paiol SHP can be evidenced by the ANEEL's (*Agência Nacional de Energia Elétrica* - National Energy Agency) Resolution that authorizes the installed capacity of 20 MW to this power plant (reference: Paiol_ResolutionANEEL-15_20100106).

Location of Paiol SHP

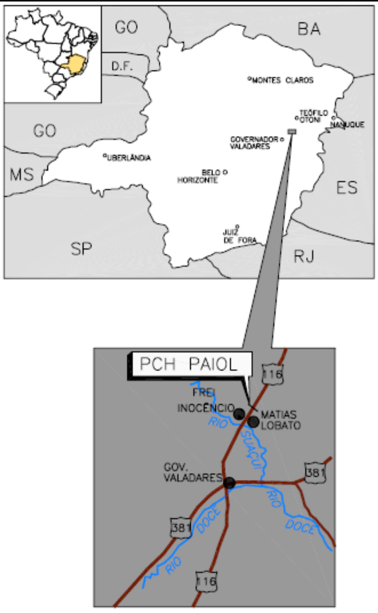


Figure 4: Location map
(Source: Environmental Impact Assessment Study - EIA of SHP)

- **São Gonçalo SHP** it is located in the city of São Gonçalo do Rio Abaixo, Minas Gerais. São Gonçalo SHP is legally represented by SPE São Gonçalo Energia S.A., being 100% of its shares owned by ERSA. It has 11 MW[5] of installed capacity and uses the hydraulic potential of Santa Bárbara River.

  The Santa Barbara River is part of the Rio Doce Basin and a tributary of the Piracicaba River, located on its left margin. SHP is located 17 km from the river's mouth. The project will demand a reservoir area with a maximum of 1.26km^2, with a power density of 8.7 MW/km^2. The geographic coordinates of project activity are 19°48'43"S and 43°15'58"W.

[5] The installed capacity of the São Gonçalo SHP can be evidenced by the ANEEL's (*Agência Nacional de Energia Elétrica* - National Energy Agency) Resolution that authorizes the installed capacity of 11 MW to this power plant (reference: SaoGoncalo_ResolutionANEEL-34_20100112).

Location of São Gonçalo SHP

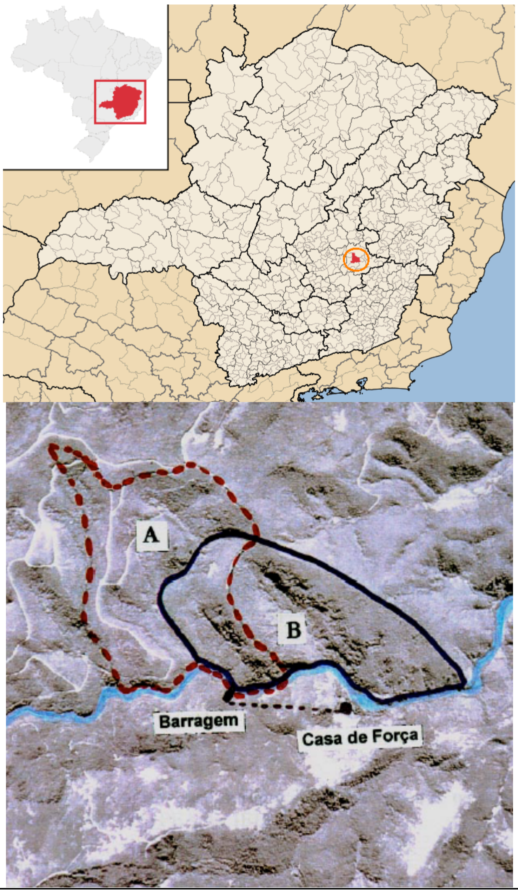


Figure 5: Location map
(Source: Environmental Impact Assessment Study - EIA of SHP)

- **Várzea Alegre SHP:** is located in the city of Conceição de Ipanema, Minas Gerais. SHP is legally represented by SPE Várzea Alegre Energia S.A., being 100% of its shares owned by ERSA. It has 7.5 MW[6] of installed capacity and uses the hydraulic potential of José Pedro River.

  The José Pedro River is part of the Rio Doce Basin, being a tributary of the Manhuaçu River, located on its right margin. SHP is located 127 km from the river's mouth. The project will demand a reservoir area with a maximum of 0.73km^2, with a power density of 10.3 MW/km^2. The geographic coordinates of project activity are 19°59'12"S and 47°43'09"W.

[6] The installed capacity of the Várzea Alegre SHP can be evidenced by the ANEEL's (*Agência Nacional de Energia Elétrica* - National Energy Agency) Resolution that authorizes the installed capacity of 7.5 MW to this power plant (reference: VarzeaAlegre_ResolutionANEEL-1424_20100520).

Location of Várzea Alegre SHP:

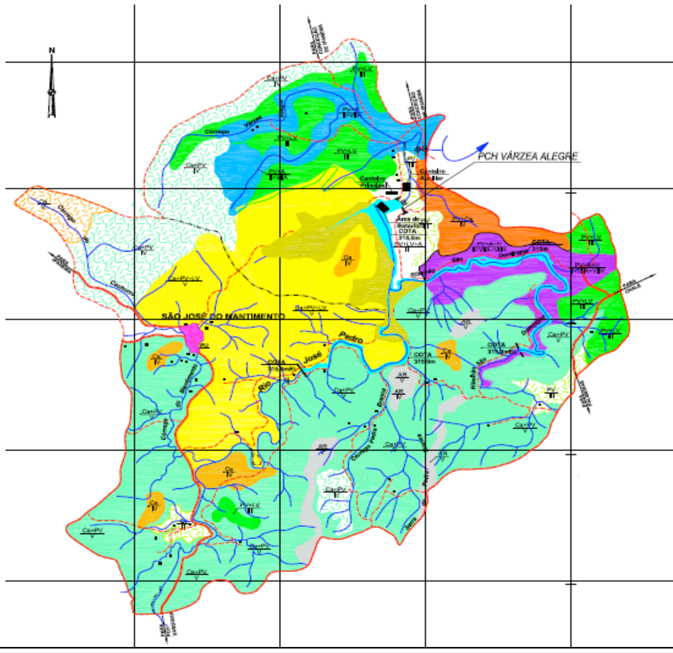



Figure 6: Location map *(Source: Environmental Impact Assessment Study - EIA of SHP)*

The primary objective of the aforementioned SHP is helping to meet the increasing power demand of Brazil, improving its supply and contributing to the increase of participation in clean and renewable sources in the National Power Matrix.

The project improves the power supply with renewable sources and also cooperates to the regional and local economic development. This power clean source has an important contribution to the environmental sustainability by reducing CO_2 emissions that would have occurred in the absence of this project. That is, the project cooperates to the environmental, social and economic sustainability resulting from the increase of the participation of renewable sources totaling the electric power consumed in Brazil.

Project activity aims at generating electric power from renewable sources through six small run-of-river hydropower plants in the state of Minas Gerais (Southeast of Brazil) with 85.5MW of installed capacity, which will reduce the emissions in 138,331tCO_2eq/year, while contributing to the increase of SHP participation into the current Brazilian scenario, in which the thermalpower plant generation from fossil fuel sources is growing.

Contributions to the Sustainable Development

Project activity will contribute to the reduction of greenhouse gas emissions by avoiding power generation from fossil fuel sources, which would be generating energy and emitting GHG in the absence of project activity. The sustainable development will be reached by project activity, since it is based on three main criteria: environmental, social and economic sustainability; as described below.

Economic criteria:

The economic criteria for sustainability will be achieved by this project since the environmental, social and technological benefits will add value to the company. The economic sustainability is achieved by linking the project implementation to CDM (Clean Development Mechanism) revenues.

Social and Environmental criteria:

The six SHPs will expand the power supply through a clean and renewable source and, at the same time, will contribute to local sustainable development. This project activity helps Brazil to reduce its dependency of large hydropower plants and thermal fossil fuel power plants, which cause larger social and environmental impacts.

In addition to the environmental benefits, there are significant social improvements due to project activity. The project will create new jobs and consequently will increase the revenue distribution and purchasing power of local population. It will also create new economic opportunities for the region, improving the power supplying conditions and the financial resources of the public administration of the city. Another benefit is related to the equipment used in SHPs, which is manufactured in Brazil and represents the offer of stable jobs and tax collection.

This project further expands SHP participation as a generating source in the region and, thus, will encourage the development of similar experiences.

Environmental Sustainability	Social Sustainability	Economical Sustainability
• Expand the energy supplied by clean and renewable sources; • Reduce the dependency of large hydropower plants and fossil fuel power plants; • Expand the Atlantic Forest areas, when deforesting 11ha and reforesting 60ha; • Expand the scientific knowledge of fauna and flora of the region; • Invest resources in Conservation Units.	• Support the growth of local community; • Improve the power supply quality; • Encourage the commerce and distribute the revenue; • Employment rate increase; • Purchasing power increase; • Expand the social and environmental awareness.	• The company's value will increase; • Sustainability will be achieved after implementing the project activity.

A.3. Project participants:

Name of Party involved (*)((host) indicates host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicates if the Party involved wishes to be considered as project participant (Yes/No)
Brazil	ERSA	No
(*) In accordance with "CDM Modalities and Procedures", at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. *At the time of requesting registration, the approval by the party (ies) involved is required.*		

For further details of project participants, please refer to Annex 1.

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.:

Southeast – Minas Gerais.

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

- **Barra da Paciência SHP**: Gonzaga and Açucena (MG).
- **Ninho da Águia SHP:** Delfim Moreira (MG).
- **Corrente Grande SHP:** Gonzaga and Açucena (MG).
- **Paiol SHP:** Frei Inocêncio and Matias Lobato (MG).
- **São Gonçalo SHP:** São Gonçalo do Rio Abaixo (MG).
- **Várzea Alegre SHP**: Conceição de Ipanema (MG).

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

Project activity comprises the implementation of six small hydropower plants in the state of Minas Gerais. The location of each SHP is shown below. The geographic coordinates represent the axis of the dam of each SHP.

- **Barra da Paciência SHP:** 18º57'00" S and 42º36'00" W.
- **Ninho da Águia SHP**: 22°30' S and 45°20' W.
- **Corrente Grande SHP:** 18°52'00"S and 42°31'00"W.
- **Paiol SHP:** 18°34'S and 41°51'W.
- **São Gonçalo SHP:** 19°48'43"S and 43°15'58"W.
- **Várzea Alegre SHP:** 19°59'12"S and 47°43'09"W.

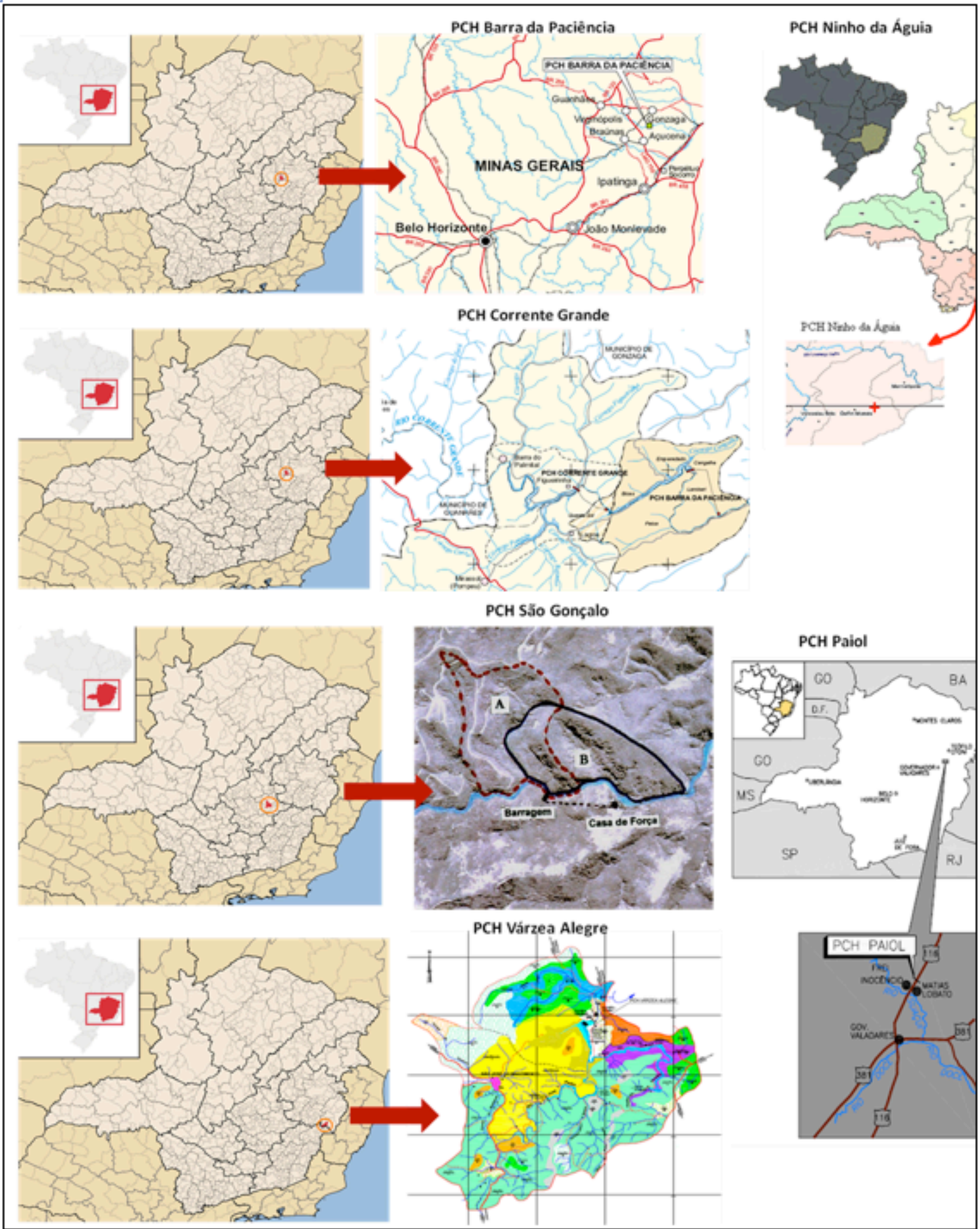


Figure 7: Location Map of the six SHPs

(Source: http://pt.wikipedia.org/wiki/Anexo:Lista_de_municípios_da_região_Sudeste_do_Brasil and Environmental Impact Assessment Study - EIA OF SHP)

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

Project activity refers to Sector 1: Energy industries (renewable -/ non-renewable sources).

This project category includes the power generation from renewable source, in which the electric power is transmitted to the National Interconnected System (Sistema Interligado Nacional – SIN).

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

In Brazil, Small Hydropower Plants (PCH - Pequenas Centrais Hidrelétricas in Portuguese) is defined as hydropower generation units with installed capacity between 1MW and 30MW (Aneel resolution 652/ December 2003), having a reservoir area lesser than $3km^2$. The project in reference is defined as a small run-of-river hydropower plant, that is, the complete volume of water that flows from the river into the plant goes through the turbines and is then completely returned to the downstream riverbed. According to Eletrobrás' definition, a run-of-river project is a project where the river flow during dry seasons is equal or higher than the minimum rate required for the turbines.

A low-level deviation dam increases sufficiently the water level, allowing the power house implementation. Water intake is normally made through a pipeline, whose downstream level is as low as possible to allow the maximum strength and move the turbines.

Run-of-river SHP

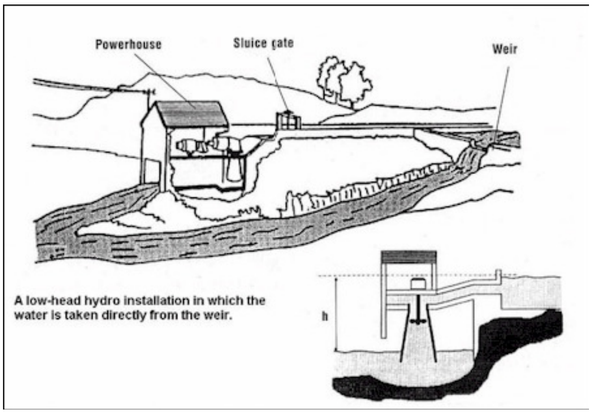


Figure 8: Schematic view of a run-of-river power plant

The technology to be implemented will be the same applied to the run-of-river reservoir, through the use of Francis and Kaplan turbines. As it was explained, the most notable characteristic of a small run-of-river hydropower plant is the absence of a large reservoir. Usually, reservoirs are required to maintain a certain level of power generation throughout the year, but if the river flow is relatively stable, the reservoir may be disregarded, reducing possible environmental impacts.

Francis turbine is a type of hydraulic reaction turbine, common in power generating stations. It is used where medium flow rates are available and it operates appropriately with medium elevation drops, being the most commonly used turbine today. The water flow goes through the turbine rotator in a radial direction in relation to its axis. The turbine can be classified as slow, normal, fast and very fast. Its efficiency varies between 75% and 90%, depending on the conditions applied. The system performance is calculated by comparing the output energy with the input energy.

Francis Turbine

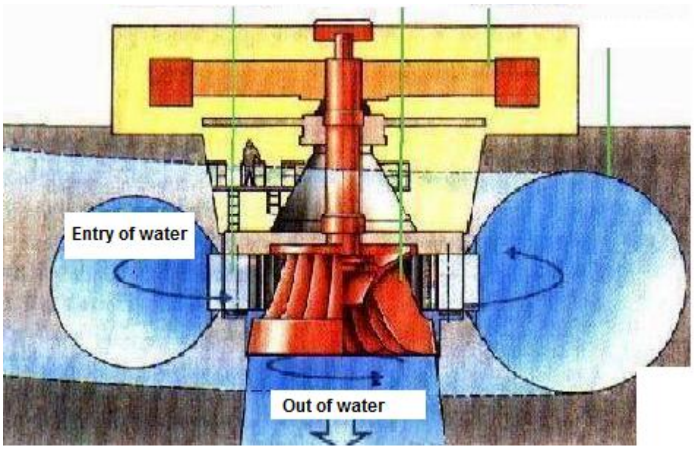


Figure 9: Francis Turbine
(Source: http://www.cepa.if.usp.br/energia/energia1999/Grupo2B/Hidraulica/turbina2.htm).

The Kaplan turbine is a type of hydraulic reaction turbine similar to Francis turbine, but adapted for lower drops and higher flow rates. The main difference from the Francis turbine is the rotator, which is composed of blades in the shape of propellers, quite similar to a ship propeller. These blades are mobile, allowing angular variation and adjustment, called variable-pitch blades. This feature enables efficiencies between 85% and 90%, given the different conditions applied. The system performance is calculated by comparing the output energy with the input energy.

Kaplan Turbine

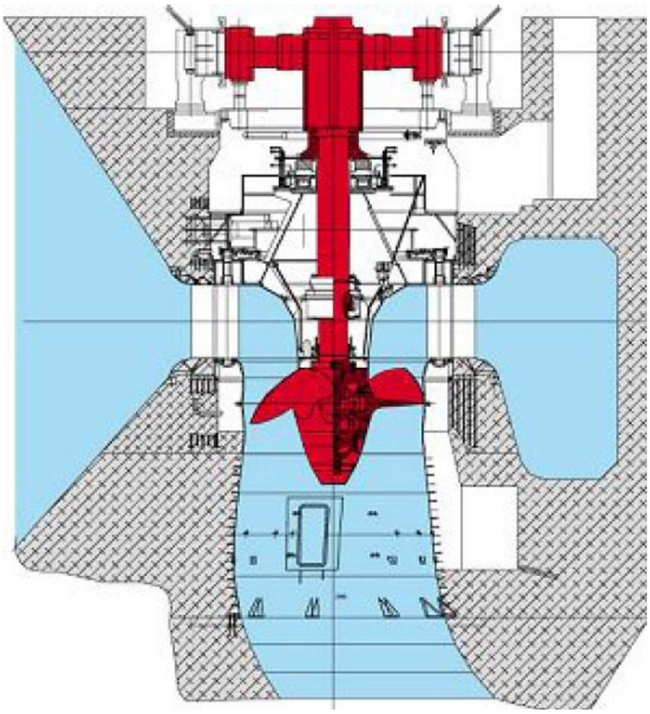



Figure 10: Kaplan Turbine *(source: http://www.estv.ipv.pt/PaginasPessoais/vasco/turbinas.pdf).*

Technical information is described in Table 1.

Table 1 - Technical information (* Leap year).

Information	Barra da Paciência	Ninho da Águia	Corrente Grande	Paiol	São Gonçalo	Várzea Alegre
POWER CAPACITY						
Installed Capacity (MW)	23[1]	10[2]	14[3]	20[4]	11[5]	7.5[6]
Average capacity (MW)	14.8	6.1	8.5	12.4	6.9	4.6
Energy consumed by SHP (MWh/year)	1447.63 / 1451.59*	613.5 / 615.18*	898.6 / 901.06*	1124.25 / 1127.33*	654.81 / 656.6*	478.51 / 479.82*
Gross Fall (m)	130.2	177.91	78.0	18.2	37.09	44.6
Reference Fall (m)	124	174	73.8	15.82	34.85	43.25
TURBINE						
Type	Francis – Horizontal axis	Francis – Horizontal axis	Francis – Horizontal axis	Kaplan S	Kaplan S	Francis – Horizontal axis
Number of Units	2	2	2	2	1	2
Nominal Capacity per Unit (MW)	11.86	5.16	7.217	10	11.4	3.87
Nominal Rotation (rpm)	600	900	600	240	400	514
Nominal Flow per Unit (m^3/s)	11	3.3	11	70	36	10.05
GENERATOR						
Number of Units	2	2	2	2	1	2
Nominal Capacity per Unit (MVA)	13.2	5.735	7.778	11.11	12.2	4.17
Nominal Voltage (kV)	6.9	13.8	6.9	6.9	6.9	6.9
Power Factor	0.9	0.9	0.9	0.9	0.9	0.9
Frequency (Hz)	60	60	60	60	60	60
RESERVOIR						
Maximum Area (Km^2)	0.52	0.017	0.98	0.65	1.26	0.73
Power Density (MW/Km^2)	44.2	588.2	14.3	30.8	8.7	10.3

The annual average energy of the six SHPs is 466,908 MWh. For 2012 and 2016, this quantity increases to 468,184 MWh because these are leap years. The Technical know-how will be transferred to local operation and maintenance teams by training programs and manuals. Project equipment will be mostly supplied by national manufacturers.

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

Year	Annual estimation of emission reductions in tonnes of CO_2e
2010**	103,666
2011	138,222
2012*	138,605
2013	138,222
2014	138,222
2015	138,222
2016*	138,605
2017**	34,556
Total estimated reductions (tonnes per CO_2 e)	968,320
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	138,331

* Leap year

** The crediting period will start in April 2010 or on the date of the registration of CDM project activity, whichever is later

A.4.5. Public funding of the project activity:

The project does not and will not involve any public funding.

SECTION B. Application of a baseline and monitoring methodology

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

Project activity will use the approved baseline and monitoring methodology ACM0002:
"Consolidated baseline methodology for grid-connected electricity generation from renewable sources", version 13.0.0, sectorial scope: 01, EB 67.

This methodology also refers to:

1. Tool for the demonstration and assessment of additionality. Version 06.1.0, EB 39.
2. Tool to calculate the emission factor for an electricity system. Version 02.2.1, EB 63.
3. Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion. Version 02, EB 41.

Reference:
UNFCCC Website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

ACM0002 methodology is applicable to project activities having grid-connected renewable power generation, which involve additional capacities. The methodology is applicable in the following conditions:

Applicability Criteria of ACM0002	Project Activity
This methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The project activity is the installation of new small hydro power plants at river points where no renewable power plant was operated prior to the implementation of the project activity (greenfield small hydro power plants).
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	Project activity herein presented is applicable to this methodology, because it is the implementation of run-of-river reservoirs hydropower plants.

In case of hydro power plants, one of the following conditions must apply: • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or • The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of the reservoirs is increased and the power density of each reservoir , as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	Project activity results new reservoirs and the power densities, as per definitions of Project Emission section, are greater than 4 W/m2.

The methodology is not applicable in the following conditions:

Non-applicability conditions of ACM0002	Project activity proposed
o Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site.	➔ The project consists of the construction of SHPs that will be implemented in points of the river where there were no power generation plants in the past, and the energy generated will be delivered directly to the national grid, so this condition is not applicable. (Thus the methodology is applicable).
o Biomass fired power plants.	➔ The project consists of the construction of SHPs not involving biomass power plants. Therefore, this condition is not applicable. (Thus the methodology is applicable).
o A hydro power plant that result in the creation of new single reservoir or the increase in the increase in an existing single reservoir, where the power density of the power plant is less than 4 W/m2.	➔ As mentioned before, the power density of all SHPs is higher than $4W/m^2$ so, this condition is not applicable. (Thus the methodology is applicable).

Considering all of the statement above, this project is qualified in ACM0002 scope.

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

According to ACM0002 methodology, the project geographical extension must include the project generation plant and all related generation plants:

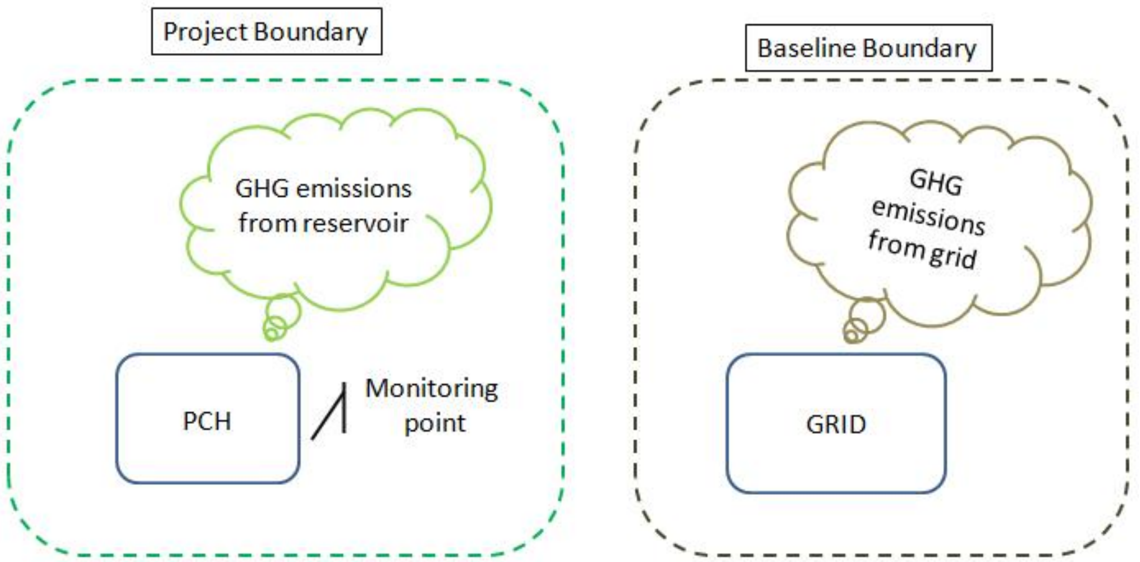
Table 2 summarizes the gases and sources included in project boundary, and clarifies and justifies where gases and sources are not included.

Table 2 - Summary of gases

	Source	Gases	Included?	Justification / Explanation
Baseline	CO_2 emissions through the electric power generated from fossil fuel generation plants, which are deviated due to project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source. .
		NO_2	No	Minor emission source.

	Source	Gases	Included?	Justification / Explanation
Project activity	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	Yes	Main emission source.
		NO_2	No	Minor emission source.

Baseline and Project boundary



ACM0002 determines that the project emission for hydropower generation that should be considered is the emission of CH_4 from the reservoirs, due to the decomposition of organic materials, only when the Power Density of the plant is below $10W/m^2$, and greater than $4W/m^2$. If the power density is greater than $10W/m^2$, project emissions can be considered as zero.

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

As stated in section II of ACM0002, version 13.0.0.

If project activity is the installation of a new grid-connected renewable power generation plant/unit, the baseline scenario is the following:

> In the absence of project activity, power energy supplied by SHPs would have been generated by the National Interconnected System operation to which the project activity plant is connected and by the addition of new generating plants, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

Therefore, the baseline scenario is identified as the continuation of current situation and future trends of electric power generation, based on large hydropower and thermal power plants. The "Tool to calculate the emission factor for an electricity system", applied to the project, uses the OM (Operating Margin) and the BM (Build Margin) to address respectively current and future GHG emissions from the operation of the grid and the thermal power plant that would have otherwise been built.

Historically, the power energy sector in Brazil has been comprised mostly by large hydropower plants. But this scenario has been changing in the past few years and the participation of thermal power plants in the total installed capacity is increasing every year.

Although the country still has a largely unexplored hydropower potential, most of it is located in the Amazon region, where the environmental restrictions imposes severe barriers to energy exploration. Furthermore, those energy sources are very distant from the main consumption areas, which are located in the southeast area of the country. Moreover, in order to meet the growing electric power demand, there has been an increase on investments in thermal power plants, whose faster construction time provides a better financial return, attracting private capital investments. Furthermore, the process of obtaining environmental licenses for thermal power plants is much faster when compared to hydroelectric.

The Decade Plan of Energy Expansion (Plano Decenal da Expansão – PDE) provides guidance to those responsible for managing balance between the projections of economic growth of the country, their impact on energy requirements and the necessary expansion of supply, based on technical, economic and environmentally sustainable criteria. According to 2008-2017 PDE, in 2013 the thermal power generation based on fossil fuel will represent 19.91% of the total installed capacity, expanding from 11% (2008) to 19.91% (2013) of the total participation of power generation in just five years.

Thus, according to ACM0002 methodology, the baseline scenario is identified as the electric power provided by the National Interconnected System and by future trends of jobs in construction. That is, the electric power is generated by large hydro and fossil fuel thermal power stations. The six SHPs will contribute to the reductions of GHG emissions of the Brazilian electric system to avoid the construction of fossil fuel-based thermal power plants.

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

Demonstration and assessment of prior consideration of the CDM

As per the "Guidelines on the demonstration and assessment of prior consideration of the CDM" (Version 04), "proposed project activities with a start date before 2 August 2008, for which the start date is prior to the date of publication of the PDD for global stakeholder consultation, are required to demonstrate that the CDM was seriously considered in the decision to implement the project activity. Such demonstration requires the following elements to be satisfied:

(a) The project participant must indicate awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project. Evidence to support this would include, inter alia, minutes and/or notes related to the consideration of the decision by the Board of Directors, or equivalent, of the project participant, to undertake the project as a CDM project activity.

(b) The project participant must indicate, by means of reliable evidence, that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation. Evidence to support this should include one or more of the following: contracts with consultants for CDM/PDD/methodology services, draft versions of PDDs and underlying documents such as letters of authorization, and if available, letters of intent, emission reduction purchase agreement (ERPA) term sheets, ERPAs or other documentation related to the potential sale of CERs (including correspondence with multilateral financial institutions or carbon funds), evidence of agreements or negotiations with a DOE for validation services, submission of a new methodology or requests for clarification or revision of existing methodologies to the CDM Executive Board, publications in newspaper, interviews with DNAs, earlier correspondence on the project with the DNA or the UNFCCC secretariat."

The Starting Date of the proposed project activity was on 23/05/2008, which represents the date when the equipment contract was assigned. The equipment contract represents the start date because it is the date on which the project participant has committed to expenditures related to the implementation of the project activity.

In the ERSA's annual information forms from 2006 and 2007, it is clearly stated that the CDM was previously considered by ERSA, and the future benefits to be obtained with the CERs' commercialization is mentioned for all the SHP portfolio of the company (references: Ersa_IAN2006_port.pdf, ERSA_IAN_2007_port.pdf). Additionally, there are other complementary evidences that confirm the CDM prior consideration in the proposed project activity:

- Feasibility Study of ERSA Company, dated from Dec/2006, which clearly demonstrates on its sections 2.6 and 2.7 that ERSA's energy projects based on renewable energy sources are eligible for CDM;
- Minute of Board Meeting, dated from 03/Oct/2007, which describes, among the matters to be discussed during the meeting, the recruitment of a consultancy company for the development of PDDs and CERs obtaining.

A summary of milestones related to the CDM prior consideration is presented in Table 3.

Table 3 - Timeline of the project activity related to the CDM prior consideration.

Date	Event	Description/ Evidences
01/Dec/2006	CDM prior consideration	Feasibility study of ERSA Company
31/Dec/2006	CDM prior consideration	Ersa_IAN2006_port.pdf
01/Oct/2007	Real action to secure the CDM status: proposal of PDD execution	Commercial proposal sent by Econergy Company to ERSA
Oct/2007	Real action to secure the CDM status: proposal of PDD execution	Commercial proposal sent by MGM International Company to ERSA
02/Oct/2007	Real action to secure the CDM status: proposal of PDD execution	Commercial proposal sent by Price Waterhouse Coopers to ERSA
03/Oct/2007	CDM prior consideration	Minute of Board Meeting
31/Dec/2007	CDM prior consideration	Ersa_IAN2007_port.pdf
07/Jan/2008	Real action to secure the CDM status: proposal of PDD execution	Contract for CDM project development between ERSA and Key Consultoria e Treinamento Ltda (project developer)
23/May/2008	Project starting date	Contract of supply equipment to the São Gonçalo SHP
23/Jan/2009	Real action to secure the CDM status: proposal of Validation	Commercial proposal sent by SGS
29/Jan/2009	Notification to the Brazilian DNA	Writing communication to the Brazilian DNA, dated from 29/Jan/2009
05/Mar/2009	Contract with RINA	Proposal RINA_NIA BPA CRG SGO POL e VAE.pdf
08/May/2009	PDD publication in the UNFCCC website	UNFCCC website: http://cdm.unfccc.int/Projects/Validation/DB/ZEH7GYTA039YNLL9X49GNGSS7V7G1O/view.html

Demonstration and assessment of additionality

According to ACM0002 methodology, the additionality of project activity shall be demonstrated and assessed using the latest version (06.1.0) of the "Tool for the demonstration and assessment of additionality" agreed by the CDM Executive Board, available at UNFCCC CDM website. Figure 11 shows the steps to be followed for demonstration of additionality according to the tool.

Since its creation, ERSA has included in its corporative strategy several social and environmental variables, aiming at ensuring the long-term sustainability of its activities. Thus, the company has a social and environmental policy that is committed to the sustainable development. Aware of the importance of contributing positively to the challenges posed by climate change, ERSA opted to build a renewable energy portfolio, making their jobs eligible to receive the carbon credits, as can be verified in the company's prospectus documents, attached as annex 5.

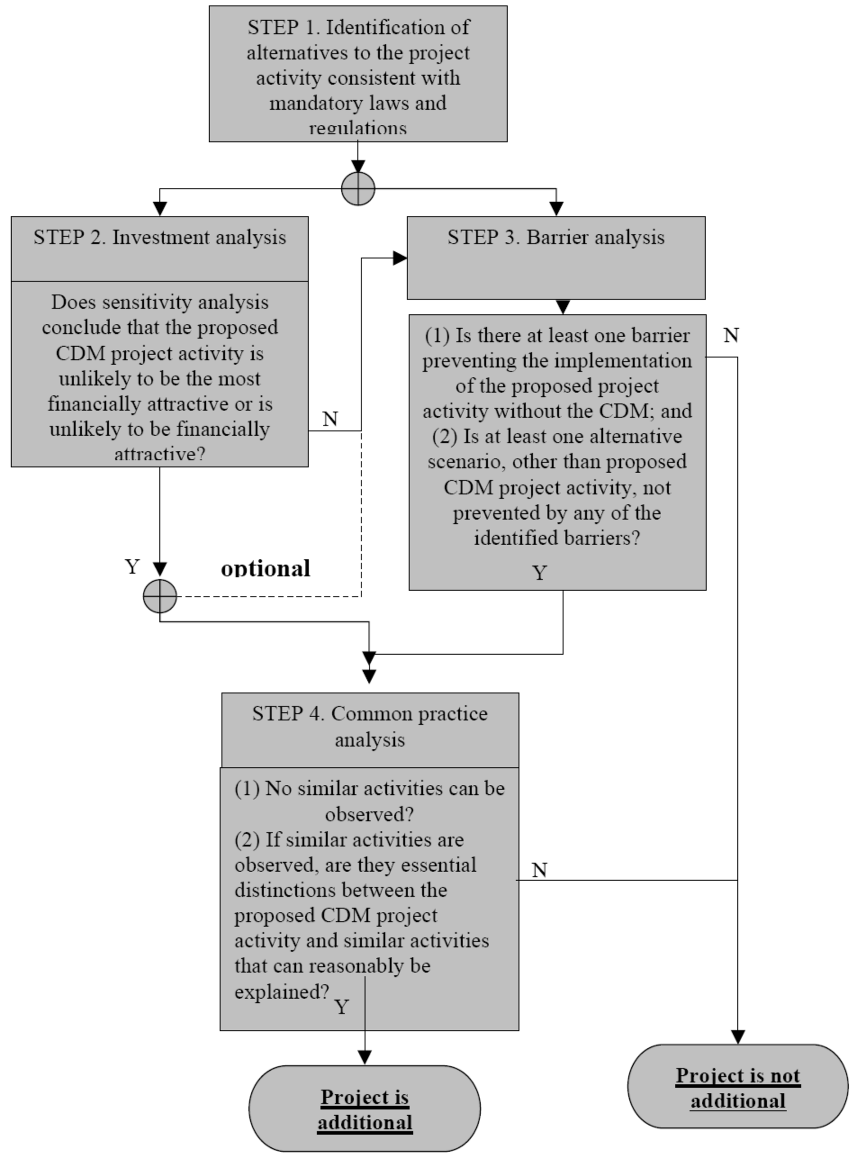


Figure 11: steps to be followed for demonstration of additionality.

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

Define realistic and credible alternatives to project activity through the following Sub-steps:

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

The following alternatives were defined, taking into account realistic and credible scenarios:

1. Implementation of the six SHPs without CDM incentive: it consists of the implementation of the SHPs to generate renewable energy.

2. Do not implement any project activity: continuation of the current scenario in which no project activity is developed and electric power is supplied by the National Interconnected System ("SIN").

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

The proposed project activity, without being registered as a CDM project, is in conformity with all Brazilian regulations and legislation applicable to the nature of its operation. This project is also in accordance with ANEEL guidelines specific for SHPs.

The combination of project alternatives is shown below:

Table 4 - Combination of *project alternatives.*

Project alternatives to project activity		
Alternative	Alternative Options	Description of situation
1	Construction of the six SHPs without CDM incentives.	***Electric power is provided by SHPs.***
2	Do not implement any project activity.	Electric power will be provided by the grid and no reduction in the GHG emission will occur.

Proceed to Step 2 (Investment analysis) and/or Step 3 (Barrier analysis).

Step 2: Investment analysis

Investment analysis determines whether the proposed project activity is not economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

According to the "*Tool for the demonstration and assessment of additionality", version 06.1.0*, to conduct the investment analysis, the following Sub-steps should be used:

Sub-step 2a: Determine appropriate analysis method

According to the tool, if the CDM project activity and the alternatives identified in Step 1 generate financial or economic benefits, other than CDM related income, then the investment comparison analysis (Option II) or the benchmark analysis (Option III) must be used. The benchmark analysis will be applied because it is more appropriate for this type of project activity in Brazil.

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

(1) Identify the financial/economic indicator, such as IRR, most suitable for the project type and decision context.

As defined in the Tool for the demonstration and assessment of additionality, Sub-step 2b, Option III: "*the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer"*. The most appropriate financial indicator for this project type is the Project Internal Rate of Return (Project IRR), since it is the annualized effective compounded rate of return that can be achieved on the invested capital. It is also appropriate since it is ERSA´s main metric in the capital budgeting and decision making process. Furthermore, if the Equity IRR is determined, it would be more difficult to define a benchmark methodology for this case, since the spread risk changes for each investor and the public information also changes, since the banks use different methodologies in their reports about the companies and so different rates. Finally, ERSA doesn't have a direct competitor in the Brazilian market that has stocks in Bovespa. So, there is no reference tax for companies of renewable energy in Brazil.

So, the Project IRR is more appropriate to this situation and it has been calculated in the investment analysis for the project activity the Project IRR (not the Equity IRR). According to the Guidelines on the assessment of investment analysis (version 05): *"Guidance: The cost of financing expenditures (i.e. loan repayments and interest) should not be included in the calculation of project IRR"*. So, the interest and principal payments were not included in the calculation of Project IRR in the investment analysis.

(2) Identify the benchmark.

One of the options to determine the benchmark is, as defined in the Tool for the demonstration and assessment of additionality (version 06.1.0), Sub-step 2b, Option III, sub-item 30: *"Discount rates and benchmarks shall be derived from: (...) (b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects*. Furthermore, the Guidelines on the assessment of investment analysis (version 05) says: "*Guidance: In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented."*

So, to meet the two items of the tool described above, the selected benchmark is defined as the Interbank Deposit – ID (*Certificados de Depósitos Interbancários - CDI)* plus a risk spread of the project (the risk spread represents the risk of this project), thus obtaining a local lending rate. The Interbank Deposit (ID) represents a commercial lending rate risk-free that enables funding transactions among financial institutions and also it is considered the risk-free rate in Brazil. As the investment in a SHP involves a wide variety of risks (environmental, engineering, financial, among others) a risk spread of the project equal to 1.05% is applied and added to the ID. So, it is possible to determine, as described in the guidance of the tool for the case of project IRR, a typical local lending rate.

The risk spread adopted is the same value defined by BNDES for each project in the financing contract, equal to 1.05%. This value is equal to 1.95% a year (total spread of BNDES) subtracted from the value of the base spread of BNDES (equal 0.9% a year). This is an adequate rate for the benchmark, since it is a rate provided by an official institute and related to the risk of the project.

A more detailed explanation about the construction of the commercial lending rate is described below:

(2.i) The construction of the benchmark rate:

As explained above the benchmark rate, according to the tool, is defined as a Local commercial lending rate (Since it is used the Project IRR). This benchmark rate is determined according to the item 30 b: "(30) Discount rates and benchmarks shall be derived from: *(...)* (b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects".

So, as explained, the local commercial lending rate was calculated based on a risk free rate (for the Brazilian case and for this project activity, the adequate risk free rate is the CDI - *Certificados de Depósitos Interbancários*), plus a risk spread of the project (the risk spread represents the risk of this project)[7]. The composition of this local commercial lending rate (risk free rate + risk spread) is a standard composition of bank lending rate in Brazil.

The basic elements of the **commercial lending rate** are:

The Financial costs (risk free rate)	+	Basic Spread (bank fee)	+	Risk Spread (project risk)

Since the bank will not lend money to a project with many risks using a risk free rate, the commercial lending rate has to incorporate rates that represent the basic bank spread (each bank has specific rates) and the risks associated to the project (determined based on the characteristics of the project). According to the definition of the Report of the Central Bank of Brazil 2006 (Banco Central do Brasil) the spread is measured as the difference between the lending rate and the funding rate of the bank and is applied over a basic rate such as the CDI[8]. The Report of the Central Bank of Brazil 2006 shows an example of a decomposition of a bank spread in different years (2001 to 2006)[9]. All the principal elements of the spread are listed in this table.

This composition of the commercial lending rate can be verified in different documents banks[10], in reports[11] and in different internet sites about the subject[12]. In CEMIG Report 2008[13], different

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[7] Report of the Central Bank of Brazil (2006). *Relatório de Economia Bancária e Crédito*, Banco Central do Brasil, 2006.

[8] Report of the Central Bank of Brazil (2006). *Relatório de Economia Bancária e Crédito*, Banco Central do Brasil, 2006 - Page 15.

[9] Report of the Central Bank of Brazil (2006). *Relatório de Economia Bancária e Crédito*, Banco Central do Brasil, 2006 - Page 12.

[10] Report of the Central Bank of Brazil (2006). *Relatório de Economia Bancária e Crédito*, Banco Central do Brasil, 2006.

Report of the Central Bank of Brazil (2007). *Relatório de Economia Bancária e Crédito*, Banco Central do Brasil, 2007.

compositions of commercial lending rates for different banks are detailed and it is possible to observe that the model used in the project activity (CDI + Spread) is widely used for many banks[14] in the composition of the **commercial lending rates**.

(2.ii) Risk Spread values utilized in the project activity

This item must explain how the risk spread is applied to the project activty. In order to do that, we had conducted a research based on public data in order to identify the basic spread applied by the banks to provide credits to borrowers. As we can remark, the basic spread used by the banks in Brazil are presented in the Reports of the Central Bank of Brazil - "Relatórios de Economia Bancária e Créditos" from the years 2004, 2005, 2006 and 2007. It is possible to notice, reading these reports that the basic spread is always higher than 20%[15]. Although the fact that these data are the average spread applied by the brazilian banks in commercial lendings rates and do not consider the specific conditions and risks of the project activity.

In order to identify a more suitable risk credit spread, we also evaluated the public spreads applied by the Banco Nacional de Desenvolvimento - BNDES. According to them, their credit risk rate goes up to 3.57% p.a. as can be verified at BNDES internet site. It is important to notice that BNDES compose its financial rate as free risk rate plus BNDEs fees, the credit risk rate and, when applicable, the fee to the financial intermediation institution.

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http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/Project_Finance/index.html

[11] CEMIG Report 2008. *Demonstrações Financeiras do Grupo CEMIG*, 2008.
CPFL Report 2008. *ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d)OF THE SECURITIES EXCHANGE ACT OF 193,* 2008.

[12]http://74.125.47.132/search?q=cache:Rm5CjCUhRgMJ:www.cndpch.com.br/zpublisher/paginas/programas_financiamento.asp+spread+de+risco+epe&cd=1&hl=pt-BR&ct=clnk&gl=br;
http://74.125.113.132/search?q=cache:6LC0MXz3RecJ:www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Areas_de_Atuacao/Infraestrutura/Energia_Eletrica/uhsa.html+project+finance+hidrelétrica+santo+antonio&cd=3&hl=pt-BR&ct=clnk&gl=br
http://74.125.47.132/search?q=cache:szQfs6HHAKwJ:www.provedor.nuca.ie.ufrj.br/provedor/arquivos/ifes/IFE1343.htm+spread+de+risco+epe&cd=2&hl=pt-BR&ct=clnk&gl=br

[13] CEMIG Report 2008. *Demonstrações Financeiras do Grupo CEMIG*, 2008.
CPFL Report 2008. *ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d)OF THE SECURITIES EXCHANGE ACT OF 193,* 2008, page 22.

[14] Banco do Brasil, Banco Itaú, Bradesco, Unibanco, others.

[15] Reports of the Central Bank of Brazil for the years 2004 to 2007 . *Relatório de Economia Bancária e Crédito*, Banco Central do Brasil, 2004, 2005, 2006 e 2007.

We also verified how the BNDES lending rate was composed to the projects of the Madeira River, as can be verified by the DOE at the BNDES site[16]. The lending rate is composed by BNDES fee, financial costs and a credit risk rate. Additionally at the BNDES site is easy to verify that BNDES has matured credit risk rate for those project that can vary from 0.46% up to 2,54%.

We also looked for the risk spread applied by BNDES to the PROINFA (Programa de Incentivo as Fontes Alternativas) and as can be verified by the DOE[17] the comercial lending rate of this projects was composed by the financial cost plus a spred of 3.5% per year, including the BNDES fee. As can be verified by the DOE[18] the basic BNDES fees for power generaton projects is 0.9%, so the average risk spread applied is 2.6% for the PROINFA projects.

We could also adopt an average value for the spread risk that would be 1.75%, considering that BNDES FINEM applied a spread risk from 0% to 3.57%. It is important to mention that the zero risk spread is applied in specific conditions, as can be verified by the DOE[19].

Considering that our adopted risk spread is smaller, what would favorable in terms of the additionality of the project, that the above spread risk. We understand that due to conservativeness is better to apply the risk spread applied by the project participants. So we prefer to keep the risk spread applied considering the fact that the contracts are public information and are registered and can be verified by the DOE.

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

(1) Calculation of the project IRR:

Before the calculation of the project IRR, it is important to explain that ERSA uses the concept of portfolio analysis in the decision marking in order to reduce the diversifiable risks. The principal goals of this analysis are: (i) approve a larger number of projects; and (ii) be more consistent in the decision making. So, the investment analysis is done for the project portfolio (in the case of this project activity, it is the six SHPs together) and not for each SHP.

Finally, the investment analysis contemplates the consolidated values gathered by the six SHPs, as well as the following main assumptions: expected revenues in MWh, original investment and operation assumptions considered by ERSA's decision makers. The total time-frame of the investment analysis is 21 years from the expected start of operations.

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[16] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Areas_de_Atuacao/Infraestrutura/Energia_Eletrica/madeira.html

[17] http://www.eletrobras.com/mostra_arquivo.asp?id=http://www.eletrobras.com/downloads/EM_Programas_Proinfa/resolproinfa.pdf&tipo=proinfa and http://www.mme.gov.br/programas/proinfa/menu/apresentacao/apresentacoes.html

[18] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/condicoes.html

[19] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/

The values utilized in the calculation of the Project IRR are depicted in Table 5.

Table 5 – Input values utilized in the Project IRR calculation.

Items	Unit	SHP						Rational / Evidences
		Barra da Paciência	Corrente Grande	Ninho da Águia	Várzea Alegre	Paiol	São Gonçalo	
PPA	R$	140.00						Power Purchase Agreement s
Net Generated Energy	MWh	14.8	8.5	6.1	4.6	12.4	6.9	Letter sent to ANEEL FAR and ERSA#043/08
Sales Tax	-	3.65% = PIS 0.65% and COFINS 3%						Article 52 of Normative Statement SRF no. 247/02
OPEX	R$ / MWh	Assumptions						O&M Contracts, policies and ANEEL Dispatch
Depreciation	year	30						Authorization Period by ANEEL (Article No. 7)
Tax Rate	-	8% gross revenues x 25%						Articles 3 and 38 of Normative Statement SRF no. 093/97 and Article 13 of Law 9,718/98
CAPEX	R$ thousands	108,685	84,970	69,269	51,466	99,033	69,139	Budget and contracts
Acquisition Value	R$ thousands	18,641	11,170	2,352	1,749	5,776	3,003	Contracts

So, after the investment analysis[20] it was determined the project IRR equal to 13.07%.

Project IRR → 13.07%

(2) Calculation of the benchmark:

For the comparative analysis is more adequate to use a longer historic data of the ID to reflect all the recent changes in the rates of the benchmark chosen. So, such analysis was made considering the last four years, based on the date of the Starting Date (23/05/2008). So, it was considered the period of 23/05/2004 to 22/05/2008[21]. The ID for this period is equal 14.99%. Considering the risk spread equal 1.05%, the benchmark rate is 16.04%

Benchmark rate → 16.04%

[20] For more details, see the investment analysis spreadsheet.

[21] This value was found by using the accumulated ID-CETIP rate calculator from 23/05/2004 to 22/05/2008, available in http://www.cetip.com.br

(3) Comparison of the Project IRR and the Benchmark rate:

The Project IRR is 13.07%, which is considerably lower than the benchmark of 16.04%.

Project IRR of 13.07% < Benchmark rate of 16.04%

According to the Tool for the demonstration and assessment of additionality (version 06.1.0), Sub-step 2c, sub-item 34 (b): *"The financial benchmark, if Option III (benchmark analysis) is used. If the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive".*

Sub-step 2d. Sensitivity Analysis.

According to the Tool for the demonstration and assessment of additionality, Sub-step 2d: *"Include a sensitivity analysis that shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 11a) or is unlikely to be financially/economically attractive (as per Step 2c para 11b)".* According to the Guidelines on the assessment of investment analysis (version 05): *"Only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (..). As a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and –10% (..)".*

So, three variables were analyzed for the sensitivity to check the robustness of the conclusion given in sub-step 2c: (1) the energy price (PPA), (2) the investment cost (CAPEX), and (3) the operational cost (OPEX).

Sensitivity Analysis of the Project IRR	
Variables	**Project IRR**
PPA (+10%)	14.38%
PPA (-10%)	11.70%
CAPEX (+10%)	12.05%
CAPEX (-10%)	14.25%
OPEX (+10%)	12.93%
OPEX (-10%)	13.21%

Even though a decrease in Capex or Opex, as well as an increase in PPA, would raise the Project IRR, it is still insufficient to equalize the commercial free lending rate plus risk spread, established as the benchmark rate.

Making a new investment analysis with the inclusion of revenues from carbon credits it is possible to get a new Project IRR and thus compare it with the benchmark rate. To perform the analysis with the inclusion of revenues from CERs, the project proponent took as its premise the average price of 15 Euros per tonne of CER. For this analysis the Project IRR is equivalent to 14.17%. That is, there is an increase of 1.1% on the Project IRR after the inclusion of revenues from CERs, making the IRR closer to the reference rate and providing a higher return for the project proponent.

Sensitivity Analysis of the Project IRR	
Variables	**Project IRR with CER**
PPA (+10%)	15.44%
PPA (-10%)	12.84%
CAPEX (+10%)	13.08%
CAPEX (-10%)	15.42%
OPEX (+10%)	14.03%
OPEX (-10%)	14.30%

Step 3: Barrier Analysis

Barrier analysis is made to complement the investment analysis and the demonstration and assessment of additionality. In this analysis, it is proved that there are many barriers that could prevent project bidders from carrying out the job undertaken without being registered as a CDM project activity.

Sub-step 3a: Identify barriers that would prevent the implementation of alternative scenarios

The more realistic and credible barriers that would prevent the implementation of the proposed project activity were evaluated and described below.

The indentified barriers are:
- Investments Barriers.
- Auction System and Future Trends Barriers

Investment Barriers

Brazil's macroeconomic environment is currently characterized by high degrees of instability and uncertainty (as displayed in the table below), which increases the difficulties involved in creating an investment analysis for projects with the same characteristics as SHP projects: the high initial investment and a very extensive *payback* period[22]. Therefore, in order to achieve the profitability that is appropriate to project risks, the analyst must foresee or establish the probabilities of all (or the most important) characteristics of the economy that will affect the prices (e.g. inflation rates, energy demand), debt (e.g. interest rate adjusted to inflation) and others. In addition to those, other difficulties that stem from the

[22] Andrade, J. O. (2006). *Pequenas Centrais Hidrelétricas: Análise das causas que impedem a rápida implementação de um programa de PCHs no Brasil*. Master's degree Report, UNIFACS.

uncertainties regarding regulatory variables (previously described), engineering variables (projects, civil construction) and environmental issues (environmental licensing and damages), may lead to scheduling changes, affect the beginning of operations, fines and other possible outcomes that might affect the project's cash flow.

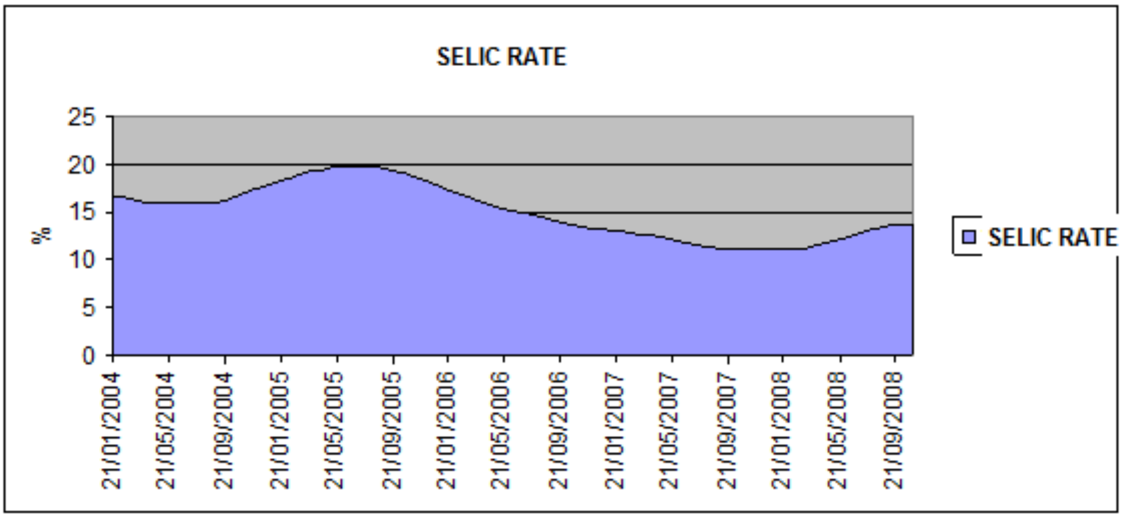
The table below contains a data set that displays the instability of the major macroeconomic indicators for the Brazilian economy:

Year	Macroeconomic Indicators			
	Inflation - IPCA (%)	R$/US$	GDP (%)	Trade Balance (US$ Million)
2000	5.9743	1.9546	4.3062	-697.7475
2001	7.6733	2.3196	1.3131	2650.4670
2002	12.5303	3.5325	2.6581	13121.2970
2003	9.2999	2.8884	1.1466	24793.9241
2004	7.6006	2.6536	5.7123	33640.5407
2005	5.6897	2.3399	3.1597	44702.8783
2006	3.1418	2.1372	3.9710	46456.6287
2007	4.4573	1.7705	5.6673	40031.6266

Source: Ipeadata

The 'Sistema Especial de Liquidação e Custódia' - SELIC (Special System of Clearance and Custody) is the central depository for all securities issued by the National Treasure and the Central Bank of Brazil and, in this condition, processes the issuance, redemption, interest payments and custody[23] relative to these securities. SELIC rate, main reference for interest rates in the country, is determined by the Comitê de Política Monetária (COPOM), the Brazilian monetary policy committee, and is often used as a monetary policy tool. SELIC rate has oscillated greatly during the past few years and, since 2004, reached a minimum of 11.25%/ year in March 2008, a maximum of 19.75% / year in May and August 2005 and an average of 15.54% / year.

[23] Source: The Central Bank of Brazil



The large instability and economic and regulatory uncertainties, combined with the characteristics of project activity, show that investments in fossil fuel power plants (especially natural gas, oil and coal) are the best options, once such projects have favorable cash flows, since they require a smaller initial investment and a smaller construction period[24]. However, this project modality based on fossil fuels does not contribute to the sustainable development and to the reduction of GEE.

The development of the project activity under the CDM will attract the investors for projects with high initial investment and a very extensive *payback* period, since they will have better revenue related to the project.

Auction System and Future Trends Barriers

Discussion below provides further evidences of power supply growing trends from fossil fuel sources.

Brazil adopted the auction system, based on the lowest price criterion, for electric power commercialization in captive market and, according to the Energy Research Company (Empresa de Pesquisa Energética – EPE), this market accounted for 74%[25] of the energy consumed in Brazil in 2006. So, a good way to prove the future trends is analyzing the results of the last national energy auctions, since the auctions are indicators of system expansion.

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[24] Andrade, J. O. (2006). *Pequenas Centrais Hidrelétricas: Análise das causas que impedem a rápida implementação de um programa de PCHs no Brasil*. Master's degree Report, UNIFACS.

[25] EPE (2007). *Estatística e Análise do Mercado de Energia Elétrica*. Monthly Report, Empresa de Pesquisa Energética

The large barrier for renewable sources related to the auction system is the competitive nature of this instrument, which creates advantages for cheaper and more competitive alternatives, such as fossil fuel power plants, reducing the participation of renewable sources[26].

The New Energy Auction is an auction that only allows the participation of generating jobs that still have not started their construction (at a given date). These auctions are separated in two categories: A-3 and A-5 Auctions, i.e. auctions where electric power will be supplied within 3 and 5 years. In other words, the new energy auction is where one can observe the future trends (3 to 5 years) of power generation. Thus, since the thermal power and hydropower auctions are separately negotiated, their results indicate the general power generation trends in thermal power and hydropower sources.

The results of 2008 new energy auctions are summarized in table 4. As it can be seen, although hydropower is still dominant in the total installed capacity, the participation of total energy sold by thermal power plants is higher than the participation of hydropower plants, representing 94.4% of the total energy sold. This result confirms the increasing trend of power supply from thermal power plants.

Table 4 – Results of the last 2 new generation auctions.

Auction	MWh negotiated		Average Price (R$/MWh)	
	Hydro	Thermal	Hydro	Thermal
New Auction 6 (2008)	0	$1.41489696 * 10^8$	0	128.42
New Auction 7 (2008)	$3.1819128 * 10^7$	$3.94941888 * 10^8$	98.98	145.23
Total	$3.1819128 * 10^7$	$5.36431584 * 10^8$		

Source: CCEE - Board of Electric Energy Commercialization
(*Câmara de Comercialização de Energia Elétrica*)

Another way to observe the trend for the increase in the participation of thermal power plants based on fossil fuels is analyzing the amount of jobs in operation, construction and granted. According to Aneel, the Brazilian Electricity Regulatory Agency, the electric power generated from fossil fuel thermal power plants currently accounts for almost 17% of the total power installed capacity. If all the plants under construction and granted (not started construction) go into operation, the total participation of electric power generated from fossil fuel thermo power plants would reach 21% of the installed capacity, indicating that this source will be more dominant in the future.

Table 5 – Jobs in Operation, construction and granting

	Operation (kW)	Operation, construction and granting (kW)
Total	$1.02635000 * 10^8$	$1.39723000 * 10^8$
Fossil fuels	$1.7083194 * 10^7$	$2.9189800 * 10^7$
Participation	16.65%	20.9%

Source: Aneel (Banco de Informação de Geração)

[26] GESEL (2009). *Dinâmica do Setor Elétrico*. Monthly Report. Grupo de Estudos do Setor Elétrico, UFRJ. - http://www.nuca.ie.ufrj.br/gesel/publicacoes/conjuntura/0907Dinamica.pdf

All the results shown indicate that the auction system, due to its competitive nature, does not provide a favourable environment for the participation of renewable sources and that the forecasts presented in the PDE 2008-2017 - Decade Plan for Electric Energy Expansion (*Plano Decenal de Expansão de Energia Elétrica*), that in 2013 the thermal power generation based on fossil fuel will represent 19.91% of the total installed capacity in Brazil, are correct and show a realistic trend.

The development of the project activity under the CDM will minimize the risk for investors and will improve the competitiveness of project, since they will have better revenue related to the project. Besides, as described above, the Brazilian electric sector itself needs to provide more incentives to enable the development of the renewable sources in the country.

Therefore, while option 1 goes against the growing trend in the sector, option 2 is in line with the identified trend.

Through the analysis presented in Sub-step 3a, one can notice that there are a series of barriers to project activity, therefore the CERs become an important factor in the decision making process as the firm selects their projects.

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

Following the analyses presented in Sub-step 3a, we can conclude that the aforementioned barriers will invalidate the implementation of alternative 1: Construction of six SHPs without CDM incentives.

1. ~~Implementation of the six SHPs without CDM incentive: it consists of the implementation of the six SHPs through renewable power.~~

2. Do not implement any project activity: continuation of the current scenario in which no project activity is undertaken and the electric power will be provided by the National Interconnected System.

All the barriers identified in the sub-step 3a do not prevent the implementation of alternative 2.

Since its creation, ERSA's aim was to focus on renewable energy supply and, in this regard, ERSA has considered, from its inception, the development of CDM projects and the income generated from the sale of CERs as an important drive to its business, as can be verified in the company's prospectus, registered at the Brazilian SEC (Securities and Exchange Commission) for the execution of the offer for share issuance, attached as Annex 5. Without the incentive of CERs, it is very probably that the company would not dedicate itself exclusively to renewable energy sources.

Step 4: Common practice analysis

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

Since the project activity belongs to measure (b) described in paragraph 6 of the "Tool for the demonstration and assessment of additionality" (version 06.1.0), the common practice analysis[27] was conducted according to the paragraph 47 of the aforementioned tool.

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity

Since the lowest installed capacity of the project activity is 10.0 MW (*Ninho da Águia* SHP) and the highest is 23.0 MW (*Barra da Paciência* SHP), the output range of the common practice analysis is 5.0 (-50% of the lowest installed capacity) – 34.5 MW (+50% of the highest installed capacity).

ANEEL (Brazilian National Electric Agency – *Agência Nacional de Energia Elétrica*) publishes the electricity generation plant units operating in Brazil (see the Common Practice analysis spreadsheet, column D). Nevertheless, the facilities complexes' installed capacity was considered in the output range determination (see the Common Practice analysis spreadsheet, column G), instead of individual plant units' installed capacity (see the Common Practice analysis spreadsheet, columns E and F)[28].

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered CDM project activities and projects activities undergoing validation shall not be included in this step.

Considering the 2,241 electricity plants in operation in Brazil, 1,836 do not deliver the same capacity as the project activity, considering the output range established in step 1 above (see the Common Practice analysis spreadsheet, column H). 61 out of the remaining 405 plants are under CDM validation or already registered (see the Common Practice analysis spreadsheet, column I). Therefore, there are 344 electricity plants in operation in Brazil that deliver the same capacity as the project activity and are not under CDM validation or already registered (see the Common Practice analysis spreadsheet, column J).

$$N_{all} = 344$$

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff}.

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[27] The common practice analysis was conducted considering the 2,274 power plants in operation in Brazil in the project starting date (28/May/2008), in accordance to the "Tool for the demonstration and assessment of additionality" (version 06.1.0), which states that "in the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project". Since the dates of entry into operation of the Brazilian grid-connected power plants are available in a monthly basis, the common practice was conducted considering power plants operating in April/2008. In April/2010, there were 2,274 grid-connected power plants in operation in Brazil (these data can be obtained in the references BrazilianElectricityGenerationMatrix_ANEEL_20120314 and BrazilianPowerPlantsOperationDate).

[28] This aggregation of plant units in complexes reduced the number of power plants connected to the national grid form 2,274 to 2,241, since some plants units are being considered as a unique power plant complex, as can be seen in the Common Practice analysis spreadsheet.

According to the “Guidelines on common practice” (version 02.0), “different technologies are technologies that deliver the same output and differ by at least one of the following:

(a) Energy source/fuel;

(…)

(d) Investment climate in the date of the investment decision, *inter alia*:

- Access to technology;
- Subsidies or other financial flows;
- Promotional policies;
- Legal regulations”.

Electricity plants being developed under PROINFA (detailed described below) and plants being developed under the Old Model of the Brazilian Electric Sector are considered as plants that apply technology different that one applied in the project activity, accordingly to the aforementioned concepts.

PROINFA (*Programa de Incentivo às Fontes Alternativas de Energia Elétrica* – Program of Incentive to Alternative Sources of Electric Energy) was launched in 2002 with the objective of increasing the participation of electricity produced from wind and biomass sources and from small hydroelectric plants in the National Interconnected System (SIN). PROINFA is based on feed in tariffs and was designed to have 2 phases. The first phase initially set a quota of 3.3 GW of new generation capacity equally distributed among wind, biomass and small hydro. After the program was launched, part of the quota of biomass was transferred to wind projects[29].

The program foresees the implementation of 144 plants, totaling 3,299.40 MW of installed capacity, being 1,191.24 MW from 63 small hydroelectric plants (1 MW - 30 MW), 1,422.92 MW from 54 wind plants and 685.24 MW from 27 biomass plants[29].

Projects developed under PROINFA have a 20-year Power Purchase Agreement signed with the state-owned electricity utility ELETROBRÁS[29]. PROINFA presets the price of the electricity paid to generators as a technology specific economic value, which is defined as the value that guarantee, for a defined timeframe and efficiency level, the economic feasibility of a typical project based on alternative sources of energy. It is worthy mentioning that the prices paid by PROINFA are higher than those currently practiced by the market (PROINFA’s wind electricity minimum price is R$180.08 and maximum price is R$204.35, adjusted by the official inflation index IGPm)[30]. However, as PROINFA no longer allows the insertion of new projects within its incentive program, this project activity is not being developed under PROINFA.

Besides, electricity generation companies that had Electricity Purchase and Sale Contracts signed with ELETROBRÁS in the ambit of PROINFA could take up a loan from the National Development Bank

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[29] Programa de Incentivo às Fontes Alternativas de Energia Elétrica/ *Program of Incentive to Alternative Sources of Electric Energy*. Available at http://www.mme.gov.br/programas/proinfa. Accessed on 11/Oct/2012.

[30] Alves de Brito, M.L. 2009. Investments in Wind Energy in Brazil: Comparing PROINFA and CDM project finance. Master Thesis. Graduate School of Humanities and Social Sciences. University of Tsukuba, Japan.

(*Banco Nacional do Desenvolvimento* – BNDES). Under the so-called Program of Financial Support to Investments in Alternative Sources of Electric Energy in the Ambit of PROINFA (*Programa de Apoio Financeiro a Investimentos em Fontes Alternativas de Energia Elétrica no Âmbito do PROINFA*), borrowers could finance up to 70% of financeable items, where the first installment could be paid up to third month after the operation start date with up to 10-year amortization periods[31].

Another differential of PROINFA for Brazilian generation companies was the electricity prices practiced in the program. For Small Hydro Power plants that sold electricity in the program, the prices in August 2010 was around R$166.00/MWh, therefore much higher than the price established by Salto Góes SHP in the 2nd Auction of Alternative Sources of Energy.

It shall be emphasized that the present proposed project activity is not part of PROINFA and the reason for that is the schedule of this program. Considering that it was launched in 2002 and forecasted the plants operation covered by the program until 2010, it was not possible to Salto Góes SHP participate of PROINFA. In this way the project activity has chosen the CDM as a benefit program.

As mentioned above, plants being developed under the Old Model of the Brazilian Electric Sector are considered as plants that apply technology different that one applied in the project activity.

In recent decades, the Brazilian Electric Sector has gone through several changes with respect to regulatory framework until the current model aiming for providing incentives for new investments in the energy sector. The reform of electric market began in 1993 with law nº 8,631, which abolished the existing tariff equalization and established supply contracts between electricity generators and distributors. The reform was also marked by the promulgation of Law nº 9,074 from 1995, which created the Independent Producer of Energy and the concept of Free Consumer.

In 1996, the Brazilian Electric Sector Restructuring Project was implemented in a first moment. The project identified the need of implementing the unbundling of energy companies, i.e., divide these companies into segments of generation, transmission and distribution, to encourage competition in the generation and commercialization segments. It has also identified the need for creation of a regulatory company, the National Agency of Electric Energy (*Agência Nacional de Energia Elétrica – ANEEL*), an operator for the national electric system, the National Operator of the System (*Operador Nacional do Sistema – ONS*), and an environment for carrying out the energy commercialization, the Wholesale Energy Market (*Mercado Atacadista de Energia – MAE*). Completed in August 1998, the Brazilian Electric Sector Restructuring Project (*Projeto de Reestruturação do Setor Elétrico Brasileiro*) defined the conceptual framework and institutional model to be implemented in the electric market.

In 2001, the electricity sector suffered a major supply crisis that culminated in a plan to ration electricity. This event generated a series of questions about the direction the Brazilian Electric Sector was treading. Aiming to adapt the existing model, was established in 2002 the Committee for the Revitalization of the Electric Sector Model (*Comitê de Revitalização do Setor Elétrico*), whose work resulted in several proposed changes in the Brazilian Electric Sector.

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[31] Program of Financial Support to Investments in Alternative Sources of Electric Energy in the Ambit of PROINFA/*Programa de Apoio Financeiro a Investimentos em Fontes Alternativas de Energia Elétrica no Âmbito do PROINFA*. Available at http://www.mme.gov.br/programas/proinfa/galerias/arquivos/programa/resolproinfa.pdf. Accessed on 03/Jan/2012.

In 2004, the Brazilian Federal Government has launched the basis of a new model for the energy sector. The new model was based on three goals as described bellow:

- ensuring security of energy supply;
- promote low tariffs;
- promote social inclusion in the energy sector.

In the new model, the planning activities in the short, medium and long term have been included as one of the mechanisms to ensure security of energy supply. Thus, in institutional terms, this new model has defined the creation of new important institutions responsible for the planning activities:

- Energy Research Company (*Empresa de Pesquisa Energética - EPE*): responsible for planning the energy sector;
- Monitoring Committee of the Power Sector (*Comitê de Monitoramento do Setor Elétrico – CMSE*): responsible for continuously assessing the security of supply of electric energy;
- Electric Energy Commercialization Chamber (*Câmara de Comercialização de Energia Elétrica – CCEE*): responsible for activities related to the sale of electricity in the interconnected system.

The Table 8 bellow evidences the several changes in the Brazilian Electric Sector.

Table 8 – Changes in the Brazilian Electric Sector along the time.

Former Model (until 1995)	Free Market Model (1995 to 2003)	New Model (2004)
Financing using public funds	Financing using public and private funds	Financing using private and public funds
Verticalized Companies	Companies classified by activity: generation, transmission, distribution and commercialization	Companies classified by activity: generation, transmission, distribution, commercialization, imports and exports.
Predominantly State- controlled companies	Opening up of the market and emphasis on the privatization of the Companies.	Coexistence between State-controlled and Private Companies.
Monopolies – No competition	Competition in generation and commercialization.	Competition in generation and commercialization.
Captive Consumers	Both Free and Captive Consumers	Both Free and Captive Consumers
Tariffs regulated throughout all sectors	Prices are freely negotiated for the generation and commercialization.	In a free environment: Prices are freely negotiated for the generation and commercialization. In a regulated environment: auctions and bids for the least tariffs.
Regulated Market	Free Market	Coexistence between Free and Regulated Markets.
Determinative Planning – Coordinator Group for the Planning of Eclectic Systems (GCPS)	Indicative Planning accomplished by the National Council for Energy Policy (CNPE)	Planning accomplished by the Energy Research Company (EPE)
Hiring: Market 100%	Hiring : Market 85% (until August/2003) and Market 95% (until December/2004)	Hiring: Market 100% + reserve
Energy Surplus/Deficit shared between the buyers.	Energy Surplus/Deficit sold in the Wholesaler Energy Market (MAE)	Energy Surplus/Deficit sold in the CCEE. Distributors Energy Surplus/Deficit compensation mechanism (MCSD).

Therefore, as the project activity SHP is expected to start operation under the Brazilian Electric Sector New Model (from 2004), the SHPs that started operation before 2004 will not be considered as similar to the proposed project activity[32].

[32] Since 2001, ANEEL (Brazilian Electric Energy National Agency) through its Generation Services Oversight Supervisory (SFG – *Superintendência de Fiscalização de Serviços de Geração*) has been publishing in its website the date (month and year) when each power plant connected to the Brazilian grid started its operation (available at http://www.aneel.gov.br/area.cfm?idArea=37&idPerfil=2). In this analysis, all the power plants connected to the Brazilian grid that started operation from 2001 onwards are included. In the Old Model of the Brazilian Electric Sector, this information was not publically available. In 1998, SFG started the survey of the existing and the new grid-connected power plants in order to consolidate the monitoring of all power plants' operation. In this way, since 2001 the SFG has been monitoring the operational starting date of all the power plants and has been publishing this information (reference: SFGManual_2009). ANEEL publishes all the grid-connected power plants in operation in Brazil (available at http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp). Since it publishes

232 out of the 344 electricity plants in operation in Brazil that deliver the same capacity as the project activity and are not under CDM validation or already registered utilize other energy source than water/hydro potential (see the Common Practice analysis spreadsheet, columns K and L), i.e. apply technology different that the one applied in the proposed project activity. 16 out of the remaining 112 hydro powers in operation in Brazil that deliver the same capacity as the project activity and are not under CDM validation or already registered are developed under PROINFA, i.e. also apply technology different that the one applied in the proposed project activity (see the Common Practice analysis spreadsheet, columns M and N). Finally, 90 out of the remaining 96 hydro powers in operation in Brazil that deliver the same capacity as the project activity, are not developed under PROINFA and are not under CDM validation or already registered were developed under the Old Model of the Brazilian Electric System, i.e. also apply technology different that the one applied in the proposed project activity (see the Common Practice analysis spreadsheet, columns M and N).

$$N_{diff} = 338$$

Step 4: Calculate factor $F = 1 - N_{diff} / N_{all}$ *representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.*

$$F = 1 - \frac{N_{diff}}{N_{all}} \Rightarrow F = 1 - \frac{338}{344} \Rightarrow F = 0.02$$

Outcome of step 4: **According to the "Tool for the demonstration and assessment of additionality" (version 06.1.0), the proposed project activity is a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff} is greater than 3. Since** $N_{all} - N_{diff} = 344 - 338 = 6$ **(i.e. higher than 3) but** $F = 0.02$ **(i.e. lower than 0.2), the proposed project activity is not a common practice within the sector in the applicable geographical area.**

Since all steps above have been satisfied, the project activity is additional.

Outcome Step 4: SATISFIED/APPROVED – The project activity is ADDITIONAL

the operational starting date of all the grid connected power plants from 2001 onwards, it is possible to determine which power plants started operation in the Brazilian Electric Sector Old Model: all the plants that started operation from 2004 onwards pertains to the New Model, all the others pertain to the Old one.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The chosen methodology is applicable to project activity, because it is a grid-connected power generation from a renewable source, where the renewable source is the Small run-of-river Power Plant connected to the Interconnected National System.

Emissions from water reservoirs of hydro power plants:

For hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoirs, estimated as follows:

(a) if the power density of the single or multiple resorvoirs (PD) is greater than 4W/m2 and less than or equal to 10W/m^2:

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000}$$

Where:
$PE_{HP,y}$: emission from the reservoir expressed as tCO_2e/year;
EF_{Res}: is the default emission factor for emissions from the reservoirs, and the default value as per EB23 is 90Kg CO_2e/MWh;
TEG_y: Total power produced by project activity, including the energy supplied to the grid and the energy consumed by internal loads, in year y (MWh).

(b) If the power density of the project activity (PD) is greater than 10W/m^2:

$$PE_{HP,y} = 0$$

The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:
PD = Power density of the project activity (W/m^2)
Cap_{PJ} = Installed capacity of the hydropower plant after the implementation of project activity (W)
Cap_{BL} = Installed capacity of the hydropower plant before the implementation of project activity (W)
For new hydro power plants, this value is zero
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of project activity, when the reservoir is full (m^2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

Baseline emissions:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$$BE_{y=} EG_{PJ,y} * EF_{grid,CM,y}$$

Where:
BE_y = Baseline emissions in year *y* (tCO_2/yr);
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);
$EF_{grid,CM,y}$ = Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO2/MWh).

I. Calculation of $EG_{PJ,y}$:

The calculation of $EG_{PJ,y}$ is different for (a) greenfield plants, (b) retrofits and replacements, and (c) capacity additions. Since this project activity is a Greenfield plant, the parameter is calculated as described next:

Greenfield renewable energy power plants:

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr).

***II.** Calculation of $EF_{grid,CM,y}$:*

With the objective of stimulating the contribution, in terms of reduction of CO_2 emissions, of CDM projects that generate energy to the grid, the Ministry of Science and Technology – MCT calculates the combined margin CO_2 emission factor for grid-connected power generation in year y using the latest version of the “Tool to calculate the emission factor for an electricity system”, as ACM0002 methodology requires. Briefly, the emission factor of the grid for CDM is a combination of emission factor of operating margin, which reflects the intensity of CO_2 emissions from energy dispatched at the margin, with the emission factor of the margin of construction, which reflects the intensity of CO_2 emissions of the last plants built. It is a widely used algorithm to quantify the contribution of a future power plant that will generate electric power to the grid in terms of reducing CO_2 emissions comparing to a baseline scenario. This factor serves to quantify the issue that is being displaced at the margin. Its usefulness is associated with CDM projects, and applies only for estimating the certified emission reductions (RCEs - Reduções Certificadas de Emissões) for CDM projects. All the documentation of the calculation method used by MCT as well as the values for the published Emission Factors can be found at MCT webpage:

According to the “Tool to calculate the emission factor for an electricity system” the project members shall apply the following six steps:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin emission factor;
STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electricity systems

The Ministry of Science and Technology - MCT adopts, for CDM project activity, a Single Electrical System for any project activity of CDM connected to the National Interconnected System and which applies the tool to calculate the emission factor for an electrical system.

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

Off-grid plants will not be included in the emission factor calculation.

Step 3: Select a method to determine operating margin (OM)

The Step 3 regards the OM calculation method. The choices available for this factor are:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

Any of the four methods can be used, however, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydropower production.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following quality of data:

• Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation.

• Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

For the dispatch data analysis OM, use the year in which the project activity displaces grid electric power and update the emission factor annually during the monitoring.

The data vintage chosen should be documented in the CDM-PDD and should not be changed during the crediting period.

Power plants registered as CDM project activities should be included in the sample group that is used to calculate the operating margin if the criteria for including the power source in the sample group apply.

OM calculation method chosen is (c) Dispatch data analysis OM, due to the fact that this is the recommended method by MCT. Moreover, MCT, along with ONS (Electric System National Operator), calculates and publishes the hourly emissions. The Dispatch data analysis does not permit to fix the Emission Factor for OM ex-ante, therefore continuous monitoring will be required to know the value of this parameter. Due to this factor, STEP 3 will not be required to be done by project members and MCT ex-post value will be used.

Step 4: Calculate the operating margin emission factor according to the selected method.

The $EF_{grid, OM, y}$ is calculated by the Brazilian DNA according to the dispatch data analysis, from which the value will be taken to calculate the ER of the project. As per this method OM emission factor is determined based on the grid power units that are actually dispatched at the margin during each hour h where the project is producing electricity and $EF_{grid, OM-DD, y}$ is calculated as follows:

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

Where:

$EF_{grid,OM-DD,y}$ = dispatch data analysis operating margin CO emission factor in year y;

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

$EF_{EL,DD,h}$ = CO_2 emission factor for power units in the top of the dispatch order in hour h in year y (tCO_2/MWh);
$EG_{PJ,y}$ = total electric power displaced by project activity in year y (MWh);
h = hours in year y in which the project activity is displacing grid electric power;
y = year in which the project activity is displacing grid electric power.

STEP 5. Calculate the build margin emission factor

The EFgrid, BM, y is calculated and published by the Brazilian Interministerial Commission for Global Climate Change, the Brazilian Designated National Authority, according to the most recent version of the "Tool to calculate the emission factor for an electricity system".

The build margin emission factor is the generation-weighted average emission factor (tCO_2/MWh) of all power generating units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:
$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh);
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh);
$EF_{EL,m,y}$ = CO2 emission factor of power generating unit m in year y (tCO2/MWh);
m = Power units included in the build margin;
y = Most recent historical year for which electricity generation data is available.

Step 6: Calculate the combined margin emission factor.

The $EF_{grid,CM,y}$ will be calculated using the latest version of the "Tool to calculate the emission factor for an electricity system". The formula applied follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM}$$

Where:
$EF_{grid,OM-DD,y}$ = CO_2 emission factor determined by the dispatch analysis data of the operating margin in year y (t CO_2/MWh);
$EF_{grid,BM,y}$ = build margin CO_2 emission factor in year y (t CO_2/MWh);
w_{BM} = weighting of build margin emission factor (%).

The following default values should be used for w_{OM} and w_{BM}:

- Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (due to their intermittent and non-dispatching nature) for the first crediting period and for subsequent crediting periods.

- All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology referring to this tool.

Alternative weights can be proposed, since $w_{OM} + w_{BM} = 1$ be submitted for the Executive Board consideration, taking into account the guidelines described below. The values for $w_{OM} + w_{BM}$ applied by project members should be fixed for a crediting period and may be revised at the renewal of the crediting period.

Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.

Emission Reductions

Emission reductions due to project activity during the year *y* are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Total emissions reductions during year *y* in tons of CO_2;

PE_y = Emissions from project activity during year *y* in tons of CO_2;

BE_y = Baseline emissions for project activity during year *y* in tons of CO_2.

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

Data / Parameter:	EF_{Res}
Data unit:	$KgCO_2/MWh$
Description:	Default emission factor for emissions from reservoirs.
Source of data used:	ACM0002 Methodology
Value applied:	90
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value as per EB23 is 90 kg CO_2e/MWh.
Any comment:	-

Data / Parameter:	SHP energy consumption
Data unit:	MWh/year
Description:	SHP energy consumption per year
Source of data used:	Job Engineering Project.
Value applied:	Barra da Paciência SHP: 1447,6 / 1451,6* Ninho da Águia SHP 613,5 / 615,2* Corrente Grande SHP: 898,6 / 901,1* Paiol SHP: 1124,3 / 1127,3* São Gonçalo SHP 654,8 / 656,6* Várzea Alegre SHP: 478,5 / 479,8*
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is a parameter of job engineering project.
Any comment:	-

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

Project activity reduces GHG emissions by avoiding the electric power generation by fossil fuel sources, which would be generating and emitting GHG in the absence of the project.

The calculation report is is presented in Annex 3.

Project Emissions:

Power densities for SHPs are:

(1) Barra da PaciênciaSHP, being reservoir level of 0.52m^2 and 23MW of installed capacity:

$$PD = \frac{23}{0.52} = 44.2$$

(2) Ninho da Águia SHP, being reservoir level of 0.017m^2 and 10MW of installed capacity:

$$PD = \frac{10}{0.017} = 588.2$$

(3) Corrente Grande SHP, being reservoir level of 0.98km^2 and 14MW of installed capacity:

$$PD = \frac{14}{0.98} = 14.3$$

(4) Paiol SHP, being reservoir level of 0.65km^2 and 20MW of installed capacity:

$$PD = \frac{20}{0.65} = 30.8$$

(5) São Gonçalo SHP, being reservoir level of 1.26km^2 and 11MW of installed capacity:

$$PD = \frac{11}{1.26} = 8.7$$

(6) Várzea Alegre SHP, being reservoir level of 0.73km^2 and 7,5MW of installed capacity:

$$PD = \frac{7.5}{0.73} = 10.3$$

So, if the power density of project is greater than 4W/m2 and less than or equal to 10W/m2, the case of São Gonçalo SHP, the project emissions are:

(5) São Gonçalo SHP: $TEG_y = 6.9 * 365 * 24 = 60{,}444 MWh$

$TEG_y = 6.9 * 366 * 24 = 60{,}610 MWh$ → leap year

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000} = 5{,}440$$

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000} = 5{,}455$$ → leap year

Baseline Emissions:

The baseline emission calculation will be based on latest data (last 12 months) given by MCT.

$$BE_{y=} EG_{PJ,y} * EF_{grid,CM,y}$$

(1) Electric power supplied by project activity to the grid in MWh is determined based on the value of annual average capacity, the days of the year, the hours in a day and the energy consumption by SHP.

(2) According to the latest data given by the MCT:

$EF_{grid,OM,y} = 0.4766$ → the average value for year 2008

$EF_{grid,BM,y} = 0.1457$ → for year 2008.

w_{OM} = 0.5 → default value.
w_{BM} = 0.5 → default value.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} = 0.3112$$

(4) The baseline emissions:

$$BE_y = 39{,}892 + 16{,}437 + 22{,}889 + 33{,}450 + 18{,}604 + 12{,}390 = 143{,}662$$

For leap year:

$$BE_y = 40{,}002 + 16{,}482 + 22{,}953 + 33{,}543 + 18{,}656 + 12{,}424 = 144{,}060$$

Leakage

According to ACM0002 methodology , no leakage is applicable.

Emission Reductions

Emission reductions due to project activity during year *y* are calculated as follows:

$$ER_y = BE_y - PE_y$$

$$ER_y = 143{,}662 - 5{,}440 = 138{,}222$$

For leap year:

$$ER_y = 144{,}060 - 5{,}455 = 138{,}605$$

Parameter	Value	Unit
ER_y	**138,222 (138,605*)**	tCO_2e / year
BE_y	143,662 (144,060*)	tCO_2e / year
PE_y	5,440 (5,455*)	tCO_2e / year
$Leakage_y$	0	tCO_2e / year

* Leap year

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

Year	Estimation of project emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
April/2010**	4,080	107,746	0	103,666
2011	5,440	143,662	0	138,222
2012*	5,455	144,060	0	138,605
2013	5,440	143,662	0	138,222

2014	5,440	143,662	0	138,222
2015	5,440	143,662	0	138,222
2016*	5,455	144,060	0	138,605
March/2017	1,360	35,916	0	34,556
Total (tonnes of CO_2e)	38,110	1,006,430	0	968,320

* Leap year.
** The crediting period will start in April 2010 or on the date of the registration of CDM project activity, whichever is later

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{facility, y}$
Data unit:	MWh/year
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y.*
Source of data to be used:	Electricity meter(s).
Value of data to be applied for the purpose of calculating expected emission reductions in section B.5	Barra da Paciência SHP: 128,200 / 128,552* Ninho da Águia SHP 52,823 / 52,967* Corrente Grande SHP: 73,561 / 73,763* Paiol SHP: 107,797 / 107,499* São Gonçalo SHP 59,789 / 59,953* Várzea Alegre SHP: 39,827 / 39,928* *leap year
Description of measurement methods and procedures to be applied:	It will be recorded hourly and filed in electronic format. Monthly the data will be consolidated in a worksheet. The worksheet will be cross-checked with the CCEE monitoring data.
QA/QC procedures to be applied:	The measurement configuration will follow the 'Measurement system for billing' that is based on regulations of the national electric sector. The meters will be periodically checked according to the mentioned regulations. Power supplied to the grid will be cross-checked according to CCEE monitoring data, which will ensure the consistency of collected data.
Any comment:	Further information please see B.7.2 description of monitoring plan

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	t CO_2/MWh
Description:	Combined factor of margin CO_2 emission for grid-connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
Source of data to be used:	Ministry of Science and Technology – MCT website http://www.mct.gov.br/index.php/content/view/303073.html
Value of data to be	0.3112 t CO_2/MWh

applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	This parameter will be calculated based on the values published by the DNA (MCT website) and the "Tool to calculate the emission factor for an electricity system", as described in item B.6.1 and B.6.3.
QA/QC procedures to be applied:	As per the "Tool to calculate the emission factor for an electricity system".
Any comment:	As per the "Tool to calculate the emission factor for an electricity system".

Data / Parameter:	TEG_y
Data unit:	MWh/year
Description:	Total energy produced by project activity, including the energy supplied to the grid and the energy consumed by internal loads, in year *y*.
Source of data to be used:	Directly measured by meters.
Value of data to be applied for the purpose of calculating expected emission reductions in section B.5	Barra da Paciência SHP: 129,648 / 130,003* Ninho da Águia SHP 53,436 / 53,582* Corrente Grande SHP: 74,460 / 74,664* Paiol SHP: 108,624 / 108,922* São Gonçalo SHP 60,444 / 60,610* Várzea Alegre SHP: 40,296 / 40,406* * Leap year.
Description of measurement methods and procedures to be applied:	It will be recorded hourly and filed in electronic format. Monthly the data will be consolidated in a worksheet.
QA/QC procedures to be applied:	Data will be monitored and recorded by ERSA.
Any comment:	-

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the single or multiple reservoirs measured in the water surface, after the implementation of project activity, when the reservoir is full.
Source of data to be used:	Project Activity Site.
Value of data to be applied for the purpose of calculating expected emission reductions in section B.5	Barra da Paciência SHP: 0,52 Ninho da Águia SHP 0,017 Corrente Grande SHP: 0,98 Paiol SHP: 0,65 São Gonçalo SHP 1,26 Várzea Alegre SHP: 0,73
Description of	It will be recorded yearly by collecting photographic evidence of the surface

measurement methods and procedures to be applied:	level when the project becomes operational. This photographic evidence will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area. Yearly the data will be consolidated in a worksheet.
QA/QC procedures to be applied:	Data will be monitored and recorded by ERSA.
Any comment:	-

Data / Parameter:	Cap_{PJ}
Data unit:	MW
Description:	Installed capacity of the small hydropower plant after the implementation of project activity.
Source of data to be used:	Project site.
Value of data to be applied for the purpose of calculating expected emission reductions in section B.5	Barra da Paciência SHP: 23 Ninho da Águia SHP 10 Corrente Grande SHP: 14 Paiol SHP: 20 São Gonçalo SHP 11 Várzea Alegre SHP: 7,5
Description of measurement methods and procedures to be applied:	It will be recorded yearly by collecting photographic evidence of the equipment nameplate capacity. Yearly the data will be consolidated in a worksheet.
QA/QC procedures to be applied:	Data will be monitored and recorded by ERSA.
Any comment:	-

B.7.2. Description of the monitoring plan:

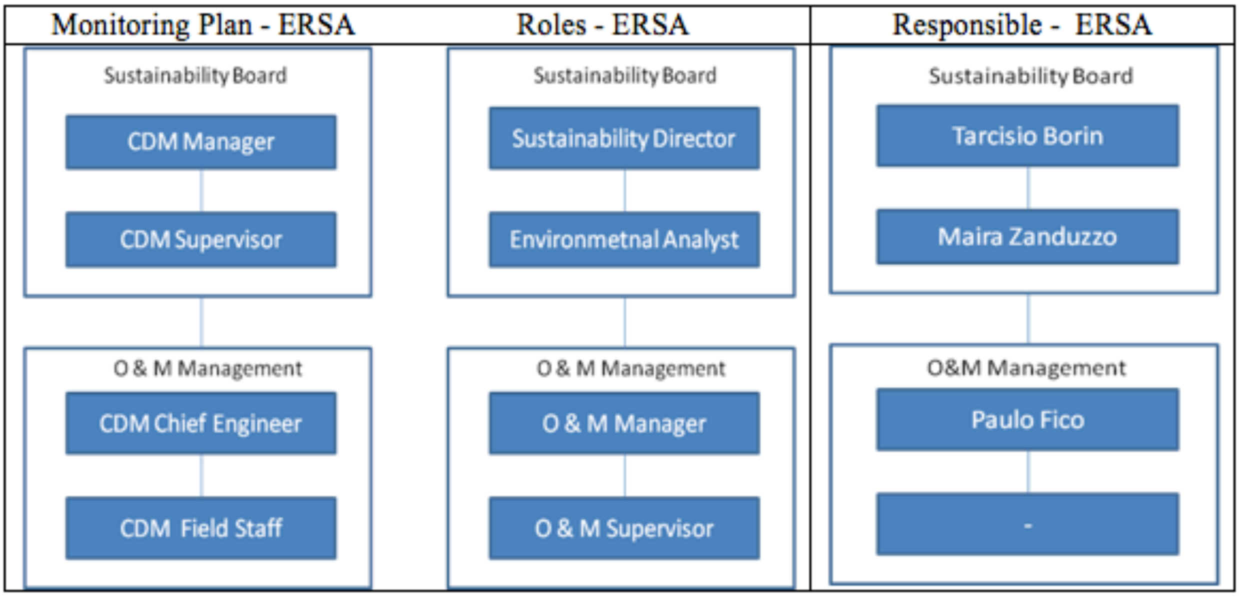
The objective of the monitoring plan is to insure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period. The project owner will be responsible for the implementation of the monitoring plan.

1. Monitoring Purpose

The main monitoring data are the total power energy supplied to the grid (*EGy)*; the emission factor of the grid ($EF_{grid,CM,y}$) will be annually provided by the Ministry of Science and Techonology (MCT), as per section B.6.1; the area of the reservoir (A_{PJ}); the installed capacity of the SHP (Cap_{PJ}) and the total energy produced by project activity, including the energy supplied to the grid and the energy consumed by internal loads (TEGy).

2. Monitoring Organization

A CDM Manager will be appointed by the project owner who supervises and verifies metering and recording, collects data (meter's data reading, sales/billing invoices), calculates emission reductions and prepares a monitoring report.



Clear roles/responsibilities are detailed below:

- **Sustainability Director/CDM Manager:**

  - Supervise and verify metering and recording: The CDM Manager will coordinate with the CDM Supervisor to ensure and verify adequate metering and recording of data, including power delivered to the grid.

- **Environmental Analyst/CDM Supervisor:** Responsible for collecting at a monthly basis all the monitored data and recording them in a specific folder where once a year a CD will be generated gathering all the monitoring results in accordance with the monitoring plan. Each SHP will have a CD with all the information regarding the monitoring plan. The CDM Supervisor will be also responsible to:

1. Calculation of emission reductions: The CDM Supervisor will calculate the annual emission reductions on the basis of net power supply to the grid, as per meter reading.

   - Preparation of monitoring report: The CDM Supervisor will annually prepare a monitoring report, which will include among others a summary of daily and/or monthly operations, metering values of power supplied to and received from the grid, copies of sales/billing invoices, a report on calibration and a calculation of emission reductions.

   - Collection of additional data, sales / purchasing invoices: The CDM Manager will collect Sales invoices for power delivered to the grid, billing invoices for power delivered by the grid to the hydropower station and additional data such as the daily operational reports of the SHP.

- Calibration: The CDM Manager will coordinate with the staff of ERSA to ensure that calibration of the metering instruments is carried out periodically in accordance with regulations of the grid company.

- **O&M Management/CDM Chief Engineer:** Daily receives the monitored data. The chief engineer will be responsible for sending worksheets with all the monitored data, at the end of every month to the supervisor. A *Monthly Monitoring Worksheet* will be generated for each SHP;

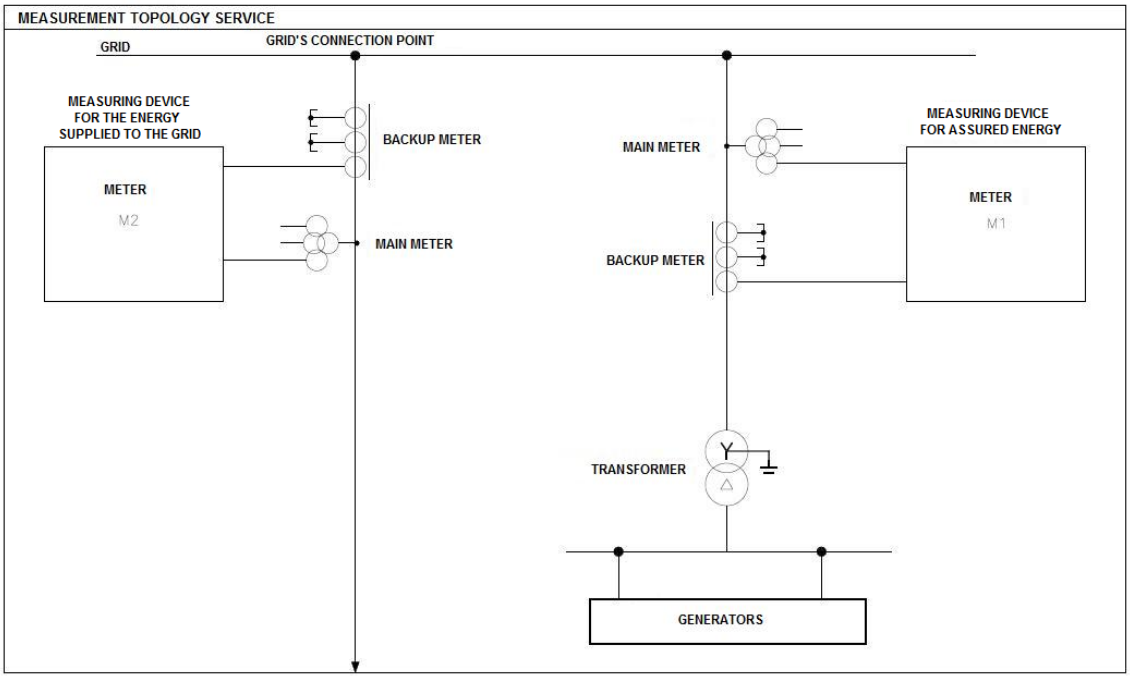
- **O&M Supervisor/CDM Field Staff:** Responsible for verifying that the monitored information are appropriatly being sent to the Electric Power Commercialization Chamber (CCEE).

In order to ensure accuracy of the monitored data, the CDM Manager will receive training on monitoring methodologies, procedures and archiving by KeyAssociados Ltda. Then, the CDM Manager will train the project staff in charge of the CDM monitoring. The training course covers:

- Initial training on CDM, monitoring methodology, monitoring procedures and requirements and archiving..

3. Monitoring Equipment and program

The electric energy metering equipment will be properly configured and the metering equipment will be checked according to relevant regulation by both the project owner and the grid company (CCEE) before the project is in operation. The figure below presents the measurement topology service and specify the location of the measuring device for assured energy and the measuring device for the energy supplied to the GRID.



4. Data Collection:

4.1 The electric data collection

In order to guarantee the quality of data from the six SHPs, the measurement configuration will follow the 'Measurement system for billing' that is based on regulations of the national electric sector.

Monthly, the monitored data will be consolidated by the Chief Engineer that will elaborate a resume worksheet with the monitored data and will provide it to the Supervisor. The Supervisor will also verify the execution of the operational procedures in the monitoring plan. All data should be approved by the Manager before it is accepted and stored.
The worksheet containing the monitored data will be checked with the sales receipts in order to assure the consistency of the generated energy data.

The main monitoring process is as follows:

i. ERSA and CCEE read and check the backup meters and the main meters and record the data on the last day of every month;
ii. CCEE supplies its readings of the main meters to ERSA. In case there are no significant discrepancies, the steps described below will be followed.
iii. ERSA records the net electricity supplied to the grid;
iv. ERSA keeps and stores the records of the main meters' data readings for verification by the DOE.

The meter reading will be readily accessible for the DOE. Calibration test records will be maintained for verification.

4.2 The surface area at full reservoir level data collection

The project owner will monitor the surface areas of the reservoirs by collecting photographic evidence of the surface level when the project becomes operational. This photographic evidence will be compared with the design reservoir dimensions to confirm whether or not the actual surface area substantially deviates from the design surface area.

The surface level of the reservoir will be recorded and readily accessible for the DOE. The photographic evidence will be maintained for verification.

5. Calibration

For approval of the enterprise along with the National Operating System requires the presentation of the calibration reports of the measurement devices that comprise the system where each measurement point presents two measurement devices: (i) main measurement device and (ii) first backup measurement device. This first backup is installed in order to guarantee the safety of the system in case the main measurement device fails to operate. This first backup device will automatically substitute the main device and will already be calibrated. The calibration process occurs in two different stages: (i) the equipments are previously calibrated by the manufacturer; (ii) after this when the plant is being tested the measurement devices are once again calibrated on site. The calibration reports will be archived together with the monitored data.

All the meters installed were tested and calibrated in accordance with regulations provided by CCEE where all the requirements were fufilled. Moreover if any errors are detected in the measuring device, it will be immediately replaced by the backup meter that will be previously calibrated. The damaged measuring device will be repair, recalibrate and will return to the monitoring system.

6. Emergency Service Plan

Each SHP has an Emergency Service Plan (Plano de Atendimento a Emergências – PEA) that has all emergency procedures related to the operation of the project activity. The goal of the Plan is define the actions, the orientations and rights to be met by the sectors involved when any emergency situation or sinister happen, aiming to control the situation and minimizing the consequences. Moreover, the Plan also has as goal the establishment of procedures to care for potential victims of accidents to provide conditions for the rapid rescue.

This plan includes definitions of preventive and emergency actions in various sectors, such as Fire Brigade, Property Surveillance, Control of Operation of the Power Plant and Substation, the Transportation Sector, Safety at Work and Staff in general.

To meet these objectives the plan defines the members of the Emergency Brigade and the preventive and emergency actions of each member. For the proper implementation of the Plan, training to all members of the Emergency Brigade is set and simulated exercises are applied. Moreover, the resources needed to maintain this Plan are identified.

7. Data Management

Data will be archived at the end of each month using electronic spreadsheets. The electronic files will be stored on hard disk and CD-ROM. In addition, a hard copy printout will be archived. ERSA will save the CCEE monitoring data regarding the power delivered to the grid and will cross-checked with the electric power measured by ERSA. At the end of each crediting year, a monitoring report will be compiled detailing the metering results and evidence.

Physical documentation such as, paper-based maps, diagrams and environmental assessment, will be collected in a central place, together with the monitoring plan. In order to facilitate the auditor's reference, monitoring results will be indexed. All paper-based information will be stored by the project owner. All data records will be kept for a period of 2 years following the end of the crediting period.

8. Monitoring Plan

The data monitoring is realized by a remote monitoring system where all parameters are monitored in real time by the CDM O&M Management in ERSA's office, located in São Paulo. At the end of each month, the Chief Engineer sends to the Supervisor a worksheet contains the resume of monitoring data, which is monitored every month. The Supervisor will record the worksheet in a specific file. At the end of each year, the Supervisor will produce a CD containing the 12 worksheets referent to each month of the year. The emissions reductions are calculated based on values from these worksheets.

The monthly worksheets will be archived every month in a specific folder for each SHP and then at the end of every year CDs will be generated compiling all this information (*Monitored Data CDs*). These CDs will compile 12 *Monthly Monitoring Worksheets* and will be stored at the headquarters of ERSA in São Paulo by the Supervisor of the Plan in the Sustainability Board. All the monitored information will be stored for a period of two years after each crediting period of the CDM project.

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

11/10/2012
Mr Carlos Henrique Delpupo;
Mr. Munir Soares and
Miss. Laura Araujo Alves

KEYASSOCIADOS
Av. Av. Paulista, 37
10º andar – Bela Vista
01311-902- São Paulo - SP
Tel: +55 (11) 3372-9572
E-mail: cdelpupo@keyassociados.com.br

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:

23/05/2008. This start date represents the date when the equipment contract was assigned. The equipment contract represents the start date because it is *the date on which the project participant has committed to expenditures related to the implementation of the project activity.*

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

25 years.

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

C.2.1. Renewable crediting period:

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

14/10/2010 or on the date of the registration of CDM project activity, whichever is later.

C.2.1.2. Length of the first crediting period:

7 years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not selected.

C.2.2.2. Length:

Not selected.

SECTION D. Environmental impacts

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

According to the law, for project development, it is necessary to obtain environmental licenses. Before the process of engineering and construction, it should be done a preliminary environmental assessment in order to receive a LP (License Prior). With such License in hand, the owner of the project has to detail and submit it to the same agency responsible for environmental LP. From that evaluation, in case of a positive result, it is obtained the LI (Installation License), which sets the requirements, as the preservation of fish stocks, restoration of riparian areas, for the construction of the project. The final license is the LO - operation license.

ERSA has the full documents that it is in compliance with all environmental laws and regulations of Host Country. The dates and numbers of the document to certify the licenses, related to the all SHPs of project activity, are listed below:

- Barra da Paciência SHP: LP was given by SUPPRAM-East on Apr. 1, 2005 → LP nº 014/08
LI was given by SUPRAM-East on Jul. 22, 2008 → LI nº 005/08
- Ninho da Águia SHP: LP was given by SUPRAM-South on May 05, 2003 → LP nº 005/02
LI was given by SUPRAM-South on Dec. 1, 2008 → LI nº 193/08
- Corrente Grande SHP: LP was given by SUPPRAM-East on Feb. 19, 2003 → LP nº 004/03
LI was given by SUPRAM-East on Jul. 22, 2008 → LI nº 006/08
- Paiol SHP: LP was given by SUPPRAM-East on Feb. 24, 2006 → LP nº 013/08
LI was given by SUPRAM-East on Jun. 11, 2008 → LI nº 007/08
- São Gonçalo SHP LP was given by SUPRAM-Central on Jun. 28, 2002 → LP nº 061/02
LI was given by SUPRAM-Central on Dec. 12, 2003 → LI nº 304/08

The Installation License from SHP São Gonçalo was renewed in 23/12/2008 and its validity was extended to 12/12/2009.

- Várzea Alegre SHP: LP was given by SUPRAM-Z.Mata on Aug. 30, 2002 → LP nº 088/02
  LI was given by SUPRAM-Z.Mata on Jun. 23, 2008 → LI nº 0179/08

The current environmental impacts and also the environmental programs and recommendations concerning the implementation of the six SHPs for electric power generation were contemplated in the document entitled "EIAs/RIMAs" - Environmental Impact Assessment Study.

Aspects of potential environmental and safety implications are discussed as follows:

Noise Pollution and Vibration
The project activity generates noise impacts and vibration only during the construction phase of the project and there is an environmental recommendation to reduce this problem.

Land Use
Project activity generates erosion due to the removal of soil vegetation cover resulting from works during the construction phase of the project. A reforestation program of degraded areas was established.

Air Pollution
There will be emission of particulate matter due to works during the construction phase of the project but with relatively low magnitude and there is an environmental recommendation of sprinkling.

Flora/Fauna
There will be the reduction of riparian forest and removal of species, being a temporary and reversible effect. A flora recovery and conservation program and continuity of botanical studies were established.

Climate impacts:
Project activity will contribute to the mitigation of climate change impacts reducing GHG emissions.

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

In case of a a run-of-river hydropower plant, the environmental impact is very small when compared to other alternatives for power generation. The identified environmental aspects of the project are presented in EIAs/RIMAs documents, which present all mitigation procedures and measures to an appropriate environmental impact management. The study was already approved by the competent environmental agencies and all environment impact adjustments are done or in process.

SECTION E. Stakeholders' comments

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

Brazilian DNA requests, in addition to UNFCCC global stakeholders' process, that project members invite comments from the specific agents mentioned above. The letters were sent on April 1, 2009 (copies of the letters and post office confirmation of receipt communication are available upon request).

The letters have been sent to the following institutions:

1. Barra da Paciência SHP:

There are no environmental institutions in Gonzaga municipality and no community associations in the Municipalities of Açucena and Gonzaga.

Stakeholders	Date Sent	Type of Delivery
City Hall of the cities of Açucena and Gonzaga, State of Minas Gerais.	01/04/2009	Certified Courier
City Council of the cities of Açucena and Gonzaga, State of Minas Gerais.	01/04/2009	Certified Courier
Secretary of Environment of the city of Açucena - Minas Gerais State.	01/04/2009	Certified Courier
Public Ministry of Brazil	01/04/2009	Certified Courier
Brazilian Forum of NGOs and Social Movements for Environment and Development http://www.fboms.org.br	01/04/2009	Certified Courier
Public Ministry of Minas Gerais state	01/04/2009	Certified Courier
Secretary of State for the Environment and Sustainable Development of Minas Gerais State.	01/04/2009	Certified Courier
Environment Association of Minas Gerais state – Amda (Associação mineira de proteção ambiental)	01/04/2009	Certified Courier

2. Ninho da Águia SHP

There are no environmental institutions and community associations in the Municipality of Delfim Moreira.

Stakeholders	Date Sent	Type of Delivery
City Hall of the city of Delfim Moreira, State of Minas Gerais.	01/04/2009	Certified Courier
City Council of Delfim Moreira, Minas Gerais state.	01/04/2009	Certified Courier
Public Ministry of Brazil	01/04/2009	Certified Courier
Brazilian Forum of NGOs and Social Movements for Environment and Development http://www.fboms.org.br	01/04/2009	Certified Courier
Public Ministry of Minas Gerais state	01/04/2009	Certified Courier
Secretary of State for the Environment and Sustainable Development of Minas Gerais State.	01/04/2009	Certified Courier
Environment Association of Minas Gerais state – Amda (Associação mineira de proteção ambiental)	01/04/2009	Certified Courier

3. Corrente Grande SHP:

There are no environmental institutions in Gonzaga municipality and no community associations in the Municipalities of Açucena and Gonzaga.

Stakeholders	Date Sent	Type of Delivery
City Hall of the cities of Açucena and Gonzaga, State of Minas Gerais.	01/04/2009	Certified Courier
City Council of the cities of Açucena and Gonzaga, State of Minas Gerais.	01/04/2009	Certified Courier
Secretary of Environment of the city of Açucena - Minas Gerais State.	01/04/2009	Certified Courier
Public Ministry of Brazil	01/04/2009	Certified Courier
Brazilian Forum of NGOs and Social Movements for Environment and Development http://www.fboms.org.br	01/04/2009	Certified Courier
Public Ministry of Minas Gerais state	01/04/2009	Certified Courier
Secretary of State for the Environment and Sustainable Development of Minas Gerais State.	01/04/2009	Certified Courier
Environment Association of Minas Gerais state – Amda (Associação mineira de proteção ambiental)	01/04/2009	Certified Courier

4. Paiol SHP:

There are no community associations in the Municipalities of Frei Inocêncio and Matias Lobato, Minas Gerais.

Stakeholders	Date Sent	Type of Delivery
City Hall of the cities of Frei Inocêncio and Matias Lobato, Minas Gerais.	01/04/2009	Certified Courier
City Council of the cities of Frei Inocêncio and Matias Lobato, Minas Gerais.	01/04/2009	Certified Courier
Secretary of Environment of the cities of Frei Inocêncio and Matias Lobato, Minas Gerais.	01/04/2009	Certified Courier
Public Ministry of Brazil	01/04/2009	Certified Courier
Brazilian Forum of NGOs and Social Movements for Environment and Development http://www.fboms.org.br	01/04/2009	Certified Courier
Public Ministry of Minas Gerais state	01/04/2009	Certified Courier
Secretary of State for the Environment and Sustainable Development of Minas Gerais State.	01/04/2009	Certified Courier
Environment Association of Minas Gerais state – Amda (Associação mineira de proteção ambiental)	01/04/2009	Certified Courier

5. São Gonçalo SHP:

Stakeholders	Date Sent	Type of Delivery
City Hall of the city of São Gonçalo do Rio Abaixo, Minas Gerais.	01/04/2009	Certified Courier
City Council of the city of São Gonçalo do Rio Abaixo, Minas Gerais.	01/04/2009	Certified Courier
Secretary of Environment of the city of São Gonçalo do Rio Abaixo, Minas Gerais.	01/04/2009	Certified Courier
Sustainable Development Association of the city of São	01/04/2009	Certified Courier

Gonçalo do Rio Abaixo, Minas Gerais.		
Public Ministry of Brazil	01/04/2009	Certified Courier
Brazilian Forum of NGOs and Social Movements for Environment and Development http://www.fboms.org.br	01/04/2009	Certified Courier
Public Ministry of Minas Gerais state	01/04/2009	Certified Courier
Secretary of State for the Environment and Sustainable Development of Minas Gerais State.	01/04/2009	Certified Courier
Environment Association of Minas Gerais state – Amda (Associação mineira de proteção ambiental)	01/04/2009	Certified Courier

6. Várzea Alegre SHP:

The municipalities of São José do Mantimento and Chalé are within the area of indirect influence, and therefore, were invited for comments regarding the Várzea Alegre SHP project. There are no community associations in the Municipalities in the Municipalities of São José do Mantimento, Conceição de Ipanema and Chalé.

Stakeholders	Date Sent	Type of Delivery
City Halls of the cities of São José do Mantimento, Conceição de Ipanema and Chalé, State of Minas Gerais.	01/04/2009	Certified Courier
City Councils of the cities of São José do Mantimento, Conceição de Ipanema and Chalé, State of Minas Gerais.	01/04/2009	Certified Courier
Environment Department of the cities of São José do Mantimento, Conceição de Ipanema and Chalé, State of Minas Gerais.	01/04/2009	Certified Courier
Public Ministry of Brazil	01/04/2009	Certified Courier
Brazilian Forum of NGOs and Social Movements for Environment and Development http://www.fboms.org.br	01/04/2009	Certified Courier
Public Ministry of Minas Gerais state	01/04/2009	Certified Courier
Secretary of State for the Environment and Sustainable Development of Minas Gerais State.	01/04/2009	Certified Courier
Environment Association of Minas Gerais state – Amda (Associação mineira de proteção ambiental)	01/04/2009	Certified Courier

The PDD of the Project in reference was made publicly available for comments during the validation phase on the web-site of UNFCCC CDM web-site (http://cdm.unfccc.int/), so that every person has access to the document from the official source.

E.2. Summary of the comments received:

No letters had been received so far.

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

No letters had been received so far.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	ERSA
Street/P.O.Box:	Av. Brigadeiro Faria Lima, 1309 - 1° andar
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E-Mail:	-
URL:	www.ersabrasil.com.br
Represented by:	Tarcisio
Title:	Director of Sustainability
Salutation:	Mr
Last Name:	Borin Junior
First Name:	Tarcisio
Department:	Sustainability
Mobile:	-
Direct FAX:	+ 55 11 3474 7450
Direct tel:	+ 55 11 3474 7430
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding was and will be used for project activity.

Annex 3

BASELINE INFORMATION

Brazilian grid emission factor source → Ministry of Science and Technology – MCT website: http://www.mct.gov.br/index.php/content/view/303073.html.

I. Baseline Emissions:

(1) Barra da Paciência SHP:

BASELINE EMISSIONS - EQUATIONS	BASELINE EMISSIONS - DATA		BASELINE EMISSIONS - CALCULATION	
	Days	365		
$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	Hours	24	$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	
EG_y : Electricity supplied by the project activity to the grid (MWh)	Average Capacity (MW)	14,8		
$EG_{baseline}$: Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.	PCH energy consumption (MWh/y)	1447,63	BR_y Until $DATE_{baselineRetrofit}$	39891,67656
$EF_{grid,CM,y}$: Combined margin CO2 emission factor for grid connected power generation in year y	EG_y	128200,37		
	$EG_{baseline} = EG_{historical}$ Until $DATE_{baselineRetrofit}$	0	BR_y After $DATE_{baselineRetrofit}$	0
Calculation of $EG_{baseline}$	$EG_{baseline} = EG_y$ After $DATE_{baselineRetrofit}$	128200,37		
$EG_{baseline}$ = 0 for new power plant	$EF_{grid,OM,y}$	0,476579705	BR_y New Power Plant	39891,67656
$EG_{baseline} = EG_{historical}$ Until $DATE_{baselineRetrofit}$	$EF_{grid,BM,y}$	0,145753547		
$EG_{baseline} = EG_y$ After $DATE_{baselineRetrofit}$	W_{OM}	0,5		
$EG_{historical}$: Average of historical electricity delivered by the existing facility to the grid (MWh).	W_{BM}	0,5		
$DATE_{baselineRetrofit}$: Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).	$EF_{grid,CM,y}$	0,311166626		

(2) Ninho da Águia SHP

BASELINE EMISSIONS - EQUATIONS	BASELINE EMISSIONS - DATA		BASELINE EMISSIONS - CALCULATION	
	Days	365		
$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	Hours	24	$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	
EG_y : Electricity supplied by the project activity to the grid (MWh)	Average Capacity (MW)	6,1		
$EG_{baseline}$: Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.	PCH energy consumption (MWh/y)	613,5	BR_y Until $DATE_{baselineRetrofit}$	16436,59909
$EF_{grid,CM,y}$: Combined margin CO2 emission factor for grid connected power generation in year y	EG_y	52822,5		
	$EG_{baseline} = EG_{historical}$ Until $DATE_{baselineRetrofit}$	0	BR_y After $DATE_{baselineRetrofit}$	0
Calculation of $EG_{baseline}$	$EG_{baseline} = EG_y$ After $DATE_{baselineRetrofit}$	52822,5		
$EG_{baseline}$ = 0 for new power plant	$EF_{grid,OM,y}$	0,476579705	BR_y New Power Plant	16436,59909
$EG_{baseline} = EG_{historical}$ Until $DATE_{baselineRetrofit}$	$EF_{grid,BM,y}$	0,145753547		
$EG_{baseline} = EG_y$ After $DATE_{baselineRetrofit}$	W_{OM}	0,5		
$EG_{historical}$: Average of historical electricity delivered by the existing facility to the grid (MWh).	W_{BM}	0,5		
$DATE_{baselineRetrofit}$: Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).	$EF_{grid,CM,y}$	0,311166626		

(3) Corrente Grande SHP:

BASELINE EMISSIONS - EQUATIONS	BASELINE EMISSIONS - DATA		BASELINE EMISSIONS - CALCULATION	
	Days	365		
$BR_y = (EG_y - EG_{baseline})*EF_{grid,CM,y}$	Hours	24	$BR_y = (EG_y - EG_{baseline})*EF_{grid,CM,y}$	
EG_y : Electricity supplied by the project activity to the grid (MWh)	Average Capacity (MW)	8,5		
$EG_{baseline}$: Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.	PCH energy consumption (MWh/y)	901,06	BR_y Until *DATE* $_{baselineRetrofit}$	22889,08716
$EF_{grid,CM,y}$: Combined margin CO2 emission factor for grid connected power generation in year y	EG_y	73558,94		
	$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	0	BR_y After *DATE* $_{baselineRetrofit}$	0
Calculation of $EG_{baseline}$	$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	73558,94		
$EG_{baseline}$ = 0 for new power plant	$EF_{grid,OM,y}$	0,476579705	BR_y New Power Plant	22889,08716
$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	$EF_{grid,BM,y}$	0,145753547		
$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	W_{OM}	0,5		
$EG_{historical}$: Average of historical electricity delivered by the existing facility to the grid (MWh).	W_{BM}	0,5		
DATE $_{baselineRetrofit}$: Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).	$EF_{grid,CM,y}$	0,311166626		

(4) Paiol SHP:

BASELINE EMISSIONS - EQUATIONS	BASELINE EMISSIONS - DATA		BASELINE EMISSIONS - CALCULATION	
	Days	365		
$BR_y = (EG_y - EG_{baseline})*EF_{grid,CM,y}$	Hours	24	$BR_y = (EG_y - EG_{baseline})*EF_{grid,CM,y}$	
EG_y : Electricity supplied by the project activity to the grid (MWh)	Average capacity (MW)	12,4		
$EG_{baseline}$: Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.	PCH energy consumption (M	1.124,25	BR_y Until *DATE* $_{baselineRetrofit}$	33450,33448
$EF_{grid,CM,y}$: Combined margin CO2 emission factor for grid connected power generation in year y	EG_y	107499,75		
	$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	0	BR_y After *DATE* $_{baselineRetrofit}$	0
Calculation of $EG_{baseline}$	$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	107499,75		
$EG_{baseline}$ = 0 for new power plant	$EF_{grid,OM,y}$	0,476579705	BR_y New Power Plant	33450,33448
$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	$EF_{grid,BM,y}$	0,145753547		
$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	W_{OM}	0,5		
$EG_{historical}$: Average of historical electricity delivered by the existing facility to the grid (MWh).	W_{BM}	0,5		
DATE $_{baselineRetrofit}$: Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).	$EF_{grid,CM,y}$	0,311166626		

(5) São Gonçalo SHP

BASELINE EMISSIONS - EQUATIONS	BASELINE EMISSIONS - DATA		BASELINE EMISSIONS - CALCULATION	
	Days	365		
$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	Hours	24	$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	
EG_y : Electricity supplied by the project activity to the grid (MWh)	Average capacity (MW)	6,9		
$EG_{baseline}$: Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.	PCH energy consumption (M	654,81	BR_y Until *DATE* $_{baselineRetrofit}$	18604,40051
$EF_{grid,CM,y}$: Combined margin CO2 emission factor for grid connected power generation in year y	EG_y	59789,19		
	$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	0	BR_y After *DATE* $_{baselineRetrofit}$	0
Calculation of $EG_{baseline}$	$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	59789,19		
$EG_{baseline}$ = 0 for new power plant	$EF_{grid,OM,y}$	0,476579705	BR_y New Power Plant	18604,40051
$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	$EF_{grid,BM,y}$	0,145753547		
$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	W_{OM}	0,5		
$EG_{historical}$: Average of historical electricity delivered by the existing facility to the grid (MWh).	W_{BM}	0,5		
DATE $_{baselineRetrofit}$: Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).	$EF_{grid,CM,y}$	0,311166626		

(6) Várzea Alegre SHP:

BASELINE EMISSIONS - EQUATIONS	BASELINE EMISSIONS - DATA		BASELINE EMISSIONS - CALCULATION	
	Days	365		
$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	Hours	24	$BR_y = (EG_y - EG_{baseline}) * EF_{grid,CM,y}$	
EG_y : Electricity supplied by the project activity to the grid (MWh)	Average capacity (MW)	4.6		
$EG_{baseline}$: Baseline electricity supplied to the grid in the case of modified or retrofit facilities (MWh). For new power plants this value is taken as zero.	PCH energy consumption (M	478.51	BR_y Until *DATE* $_{baselineRetrofit}$	12389.87401
$EF_{grid,CM,y}$: Combined margin CO2 emission factor for grid connected power generation in year y	EG_y	39817.49		
	$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	0	BR_y After *DATE* $_{baselineRetrofit}$	0
Calculation of $EG_{baseline}$	$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	39817.49		
$EG_{baseline}$ = 0 for new power plant	$EF_{grid,OM,y}$	0.476579705	BR_y New Power Plant	12389.87401
$EG_{baseline} = EG_{historical}$ Until *DATE* $_{baselineRetrofit}$	$EF_{grid,BM,y}$	0.145753547		
$EG_{baseline} = EG_y$ After *DATE* $_{baselineRetrofit}$	W_{OM}	0.5		
$EG_{historical}$: Average of historical electricity delivered by the existing facility to the grid (MWh).	W_{BM}	0.5		
DATE $_{baselineRetrofit}$: Point in time when the existing equipment would need to be replaced in the absence of the project activity (date).	$EF_{grid,CM,y}$	0.311166626		

II. Project Emissions:

(1) Barra da Paciência SHP:

PROJECT EMISSION - EQUATION	PROJECT EMISSIONS - DATA		PROJECT EMISSIONS - CALCULATION	
Hydro power plants				
	EF_{RES}	90	PE_y	PE is equal 0
(a) If the power density (PD) of power plant				
is greater than 4 W/m2 and less than or equal to 10 W/m2:	TEG_y	129648		
$PE_y = EF_{RES}*TEG_y / 1000$				
PE_y : Emission from reservoir expressed as tCO2e/year				
EF_{RES}: is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO2e /MWh.			PE_y option (a)	11668,32
TEG_y : Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).				
	Cap_{PJ}	23,70		
(b) If the power density (PD) of the power plant is greater than 10 W/m2:	Cap_{BL}	0		
$PE_y = 0$	A_{PJ}	0,52		
	A_{BL}	0		
The power density of the project activity is calculated as follows:	PD	45,57692308		
$PD = Cap_{PJ} - Cap_{BL} / A_{PJ} - A_{BL}$				
PD : Power density of the project activity, in W/m2.				
Cap_{PJ} : Installed capacity of the hydro power plant after the implementation of the project activity (W).				
Cap_{BL} : Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero				

(2) Ninho da Águia SHP

PROJECT EMISSION - EQUATION	PROJECT EMISSIONS - DATA		PROJECT EMISSIONS - CALCULATION	
Hydro power plants				
	EF_{RES}	90	PE_y	PE is equal 0
(a) If the power density (PD) of power plant				
is greater than 4 W/m2 and less than or equal to 10 W/m2:	TEG_y	53436		
$PE_y = EF_{RES}*TEG_y / 1000$				
PE_y : Emission from reservoir expressed as tCO2e/year				
EF_{RES}: is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO2e /MWh.			PE_y option (a)	4809,24
TEG_y : Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).				
	Cap_{PJ}	10,30		
(b) If the power density (PD) of the power plant is greater than 10 W/m2:	Cap_{BL}	0		
$PE_y = 0$	A_{PJ}	0,017		
	A_{BL}	0		
The power density of the project activity is calculated as follows:	PD	605,8823529		
$PD = Cap_{PJ} - Cap_{BL} / A_{PJ} - A_{BL}$				
PD : Power density of the project activity, in W/m2.				
Cap_{PJ} : Installed capacity of the hydro power plant after the implementation of the project activity (W).				
Cap_{BL} : Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero				

(3) Corrente Grande SHP:

PROJECT EMISSION - EQUATION	PROJECT EMISSIONS - DATA		PROJECT EMISSIONS - CALCULATION	
Hydro power plants				
	EF_{RES}	90	PE_y	PE is equal 0
(a) If the power density (PD) of power plant				
is greater than 4 W/m2 and less than or equal to 10 W/m2:	TEG_y	74460		
$PE_y = EF_{RES}*TEG_y / 1000$				
PE_y : Emission from reservoir expressed as tCO2e/year				
EF_{RES}: is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO2e /MWh.			PE_y option (a)	6701,4
TEG_y : Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).				
	Cap_{PJ}	14,60		
(b) If the power density (PD) of the power plant is greater than 10 W/m2:	Cap_{BL}	0		
$PE_y = 0$	A_{PJ}	0,98		
	A_{BL}	0		
The power density of the project activity is calculated as follows:	PD	14,89795918		
$PD = Cap_{PJ} - Cap_{BL} / A_{PJ} - A_{BL}$				
PD : Power density of the project activity, in W/m2.				
Cap_{PJ} : Installed capacity of the hydro power plant after the implementation of the project activity (W).				
Cap_{BL} : Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero				

(4) Paiol SHP:

PROJECT EMISSION - EQUATION	PROJECT EMISSIONS - DATA		PROJECT EMISSIONS - CALCULATION	
Hydro power plants				
	EF_{RES}	90	PE_y	PE is equal 0
(a) If the power density (PD) of power plant				
is greater than 4 W/m2 and less than or equal to 10 W/m2:	TEG_y	108.624,00		
$PE_y = EF_{RES}*TEG_y / 1000$				
PE_y : Emission from reservoir expressed as tCO2e/year				
EF_{RES}: is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO2e /MWh.			PE_y option (a)	9776,16
TEG_y : Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).				
	Cap_{PJ}	20		
(b) If the power density (PD) of the power plant is greater than 10 W/m2:	Cap_{BL}	0		
$PE_y = 0$	A_{PJ}	0,65		
	A_{BL}	0		
The power density of the project activity is calculated as follows:	PD	30,76923077		
$PD = Cap_{PJ} - Cap_{BL} / A_{PJ} - A_{BL}$				
PD : Power density of the project activity, in W/m2.				
Cap_{PJ} : Installed capacity of the hydro power plant after the implementation of the project activity (W).				
Cap_{BL} : Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero				

(5) São Gonçalo SHP

PROJECT EMISSION - EQUATION	PROJECT EMISSIONS - DATA		PROJECT EMISSIONS - CALCULATION	
Hydro power plants				
	EF_{RES}	90	PE_y	PE is provided by Option (a) in C8
(a) If the power density (PD) of power plant				
is greater than 4 W/m2 and less than or equal to 10 W/m2:	TEG_y	60.444,00		
$PE_y = EF_{RES}*TEG_y / 1000$				
PE_y : Emission from reservoir expressed as tCO2e/year				
EF_{RES}: is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO2e /MWh.			PE_y option (a)	5439,96
TEG_y : Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).				
	Cap_{PJ}	11		
(b) If the power density (PD) of the power plant is greater than 10 W/m2:	Cap_{BL}	0		
$PE_y = 0$	A_{PJ}	1,26		
	A_{BL}	0		
The power density of the project activity is calculated as follows:	PD	8,73015873		
$PD = Cap_{PJ} - Cap_{BL} / A_{PJ} - A_{BL}$				
PD : Power density of the project activity, in W/m2.				
Cap_{PJ} : Installed capacity of the hydro power plant after the implementation of the project activity (W).				
Cap_{BL} : Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero				

(6) Várzea Alegre SHP:

PROJECT EMISSION - EQUATION	PROJECT EMISSIONS - DATA		PROJECT EMISSIONS - CALCULATION	
Hydro power plants				
	EF_{RES}	90	PE_y	PE is equal 0
(a) If the power density (PD) of power plant				
is greater than 4 W/m2 and less than or equal to 10 W/m2:	TEG_y	40296		
$PE_y = EF_{RES}*TEG_y / 1000$				
PE_y : Emission from reservoir expressed as tCO2e/year				
EF_{RES}: is the default emission factor for emissions from reservoirs, and the default value as perEB23 is 90 Kg CO2e /MWh.			PE_y option (a)	3626.64
TEG_y : Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh).				
	Cap_{PJ}	7.50		
(b) If the power density (PD) of the power plant is greater than 10 W/m2:	Cap_{BL}	0		
$PE_y = 0$	A_{PJ}	0.73		
	A_{BL}	0		
The power density of the project activity is calculated as follows:	PD	10.2739726		
$PD = Cap_{PJ} - Cap_{BL} / A_{PJ} - A_{BL}$				
PD : Power density of the project activity, in W/m2.				
Cap_{PJ} : Installed capacity of the hydro power plant after the implementation of the project activity (W).				
Cap_{BL} : Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero				

Annex 4

MONITORING INFORMATION

Annex 5

PARTS OF COMPANY'S PROSPECTUS REGISTERED AT THE BRAZILIAN SEC

This annex contains periods taken from the company's prospectus, registered at the Brazilian SEC (Securities and Exchange Commission) for the execution of the offer for share issuance. These periods serve to show that the sale of carbon credit has always been part of the company's Business Plan and that ERSA works only in the industry of renewable energy.

- Projects with sustainability and exclusive focus on the generation of renewable energy. Our portfolio of projects exclusively uses renewable sources of energy with low environmental impact in their implementation and operation. The creation of power generation investment portfolio from renewable sources benefits from the global trend towards fostering non-polluting energy generation sources. We believe that the low environmental and social impacts of our portfolio constitutes an important strength of our business, not only for the significant reduction of the risks involved in obtaining the environmental licenses and authorizations required for the implementation and operation of our power plants, but also because we are not exposed to the volatility of fossil fuel market prices. Additionally, our renewfossilke energy plants are eligible for the clean development mechanism and may benefit from the sale of carbon credits. Finally, the generation of renewable energy may allow us broad access to funding sources, given that most major banks that finance energy generation projects abide by the Ecuador Principles.

- ***For further information, see "Industry—International Environmental Standards and Policies on Sustainability."*** We intend to invest exclusively in renewable power generation projects in the different phases they are, applying our discipline in the identification, development and implementation of projects. In the first phase of our business plan, we have focused primarily on SHP and wind farm projects. Actually, besides the SHPs, we have turned our efforts to Wind Power Plant projects as well. The next phases of our business plan may also involve Biomass Plants and new energy sources, including solar energy and biogas, among others. The use of renewable natural resources tends to attract increasing investments as a result of the expected increasing demand for energy, rising prices and lower environmental impact. Scenarios of scarce energy and high prices favor the implementation of new SHPs and other renewable energy plants, such as wind farms, given that they generate clean energy and enjoy several incentives, such as discounts in regulatory fees and generation of carbon credits.

- ***Carbon Credits and the Clean Development Mechanism***
  Climate change poses challenges to society. Being aware of the significant impact that energy generation companies have on this issue, we have made the strategic decision to construct a portfolio from renewable sources of energy.

  The Kyoto protocol is an international treaty under which the signatory countries have undertaken to reduce the emission of greenhouse gases, which are, according to most scientific investigations, the cause of global warming. Discussed and negotiated in Japan in 1997, the Kyoto protocol came into force in February 2005, subsequent to Russia's ratification in November 2004.

This treaty provides for a mechanism through which developed countries are required to reduce the volume of greenhouse gases by at least 5.2% by 2012, based on 1990 levels. The signatory countries must put into practice plans for reducing emissions of these gases between 2008 and 2012. A reduction of emissions is expected from different economic activities. Specifically, the protocol fosters the mutual cooperation of signatory countries through certain basic actions, including promotion of the use of renewable energy sources and the protection of forests and other carbon "sinks."

One of the Kyoto protocol's fundamental mechanisms is the clean development mechanism, which establishes a market for certified emission reductions, or carbon credits, whereby companies and countries not complying with emission targets may purchase credits for emission-reduction projects. Renewable sources are considered clean energy given that they generate energy without the use of fossil fuels, thus minimizing the emission of gases that contribute to global warming. This renders the projects eligible to receive carbon credits, and as a result we will receive additional revenues.

Annex 6

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