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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Project title: *Teles Pires Hydropower Plant Project Activity*

PDD version number: 1.0 (version for local and global stakeholders' consultation processes)

Date: 30/12/2011

A.2. Description of the project activity:

The primary objective of the *Teles Pires Hydropower Plant Project Activity* (hereafter referred to as the "**Project**") is to help meet Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to the environmental, social and economic sustainability by increasing renewable energy's share of the total Brazilian (and the Latin America and the Caribbean region's) electricity consumption.

The Latin America and the Caribbean region countries have expressed their commitment towards achieving a target of at least 10% renewable energy of the total energy use in the region. Through an initiative of the Ministers of the Environment in 2002[1], a preliminary meeting of the *World Summit for Sustainable Development* (WSSD) was held in Johannesburg in 2002. In the WSSD final Plan of Implementation no specific targets or timeframes were stated, however, their importance was recognized for achieving sustainability in accordance with the Millennium Development Goals[2].

The Brazilian electricity sector privatization process initiated in 1995 arrived with an expectation of moderate tariffs and better prices for generators. It drew the attention of investors to possible alternatives not available in the previous centrally planned electricity market. But at the end of the 1990's an over average increase in demand, in contrast with an under-average investment in new power generations, caused the supply crisis/rationing from 2001/2002. One of the solutions the government provided was a more flexible and private initiative friendly legislation. Furthermore, investors were already aware of the potential eligibility under the Clean Development Mechanism of the Kyoto Protocol for hydropower projects.

This indigenous and cleaner source of electricity has an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the hydropower projects.

[1] UNEP (2002*). Final Report of the 7th Meeting of the Inter-Sessional Committee of the Forum of Ministers of the Environment of Latin America and the Caribbean* (15-17 May 2002, Sao Paulo, Brazil). United Nations Environment Programme, Regional Office for Latina America and the Caribbean.

[2] WSSD Plan of Implementation, Paragraph 19 (e): "Diversify energy supply by developing advanced, cleaner, more efficient, affordable and cost-effective energy technologies, including fossil fuel technologies and renewable energy technologies, hydro included, and their transfer to developing countries on concessional terms as mutually agreed. With a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply, recognizing the role of national and voluntary regional targets as well as initiatives, where they exist, and ensuring that energy policies are supportive to developing countries' efforts to eradicate poverty, and regularly evaluate available data to review progress to this end."

The hydropower project reduces emissions of *greenhouse gas* (GHG) by avoiding electricity generation by fossil fuel sources (and CO_2 emissions), which would necessary in the absence of the Project.

The Project will make use of the hydrological resources of the Teles Pires River between the cities of Paranaita and Jacareacanga, Brazil, in order to generate greenhouse gases (GHG) emission free electricity to be dispathched into the *Brazilian National Interconnected System* (**SIN**, from the Portuguese, "Sistema Interligado Nacional"), thereby displacing more carbon-intensive electricity generation, reducing GHG emissions. The baseline scenario is the continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system.

The Project consists of implementing a hydropower plant with a total installed capacity of 1,820 MW[3]. The power plant is expected to be fully operational by 2015.

The Project is owned by *Companhia Hidrelétrica Teles Pires*, a *special purpose company* (SPC) composed by the following shareholders structure[4]:

- Neoenergia S.A., 50.1%
- Furnas Centrais Eletricas S.A., 24.5%
- Eletrosul Centrais Eletricas S.A., 24.5%
- Odebrecht Participações e Investimentos S.A., 0.9%

The Project contributes to sustainable development for many reasons, to name but a few:

- Increases short, mid and long-term employment opportunities in the area where it is located during construction and operation;
- Enhances the local investment environment and, therefore, improves the local economy;
- Diversifies the sources of electricity generation and promote regional integration. This is important for meeting growing energy demands, and transitioning away from fossil-fuel-fired electricity generation in the whole country, but markedly in the region.
- Makes use of renewable hydroelectric resources.

It is also worth mentioning that, taking into account that it is a "prerogative of the host country on the design and implementation of policies to promote or give competitive advantage to low greenhouse gas emitting fuels and technologies[5]," the Brazilian Government already in the first version of its *National Plan on Climate Change*[6], released in 2008, included the goal to increase hydropower generation. In the plan planned hydropower plants are referenced as cumulatively reducing 184 million tCO_2e. The goal was later communicated by the Brazilian Government to the UNFCCC in January 2010[7], as a follow up of the Copenhagen Accord, as follows:

[3] Despacho ANEEL Nº 3.504, de 26 de Agosto de 2011.
[4] Aviso de adjudicação e homologação Leilão N. 04/2010 ANEEL.
[5] UNFCCC (2009). Decision 5/CMP.5, paragraph 11.
[6] Comitê Interministerial sobre Mudança do Clima (2008). Plano Nacional sobre Mudança do Clima.
[7] Communication from the Government of Brazil to the UNFCCC indicating the intended nationally appropriate mitigation actions, the use of the CDM not excluded (29 January 2010). Retrieved on 04/10/2011 from http://unfccc.int/meetings/cop_15/copenhagen_accord/items/5262.php.

Increase in energy supply by hydroelectric power plants (range of estimated reduction: 79 to 99 million tons of CO2 eq in 2020).

From the above it is clear that the project not only contributes to sustainable development but is also in line with the planned national climate change mitigation actions.

A.3. Project participants:

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

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

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

States of Mato Grosso (MT) and Pará (PA)

A.4.1.3. City/Town/Community etc:

Paranaíta (MT) and Jacareacanga (PA)

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

Teles Pires Hydropower Plant Project Activity is located at the intersection of the following geographic coordinates[3]:

- Latitude: 9°21'04'' S
- Longitude: 56°46'39'' W

Figure 1 - Political division of Brazil showing the states of Mato Grosso and Pará on the left and a Google Earth image showing the cities involved in the project activity

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

Renewable electricity generation for a grid.

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

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

Prior to the implementation of the project activity no electricity was generated in the place where the project is located. Therefore, the electricity to be generated by the plant which is going to be dispatched into the national grid would be generated by the mix of plants connected to SIN.

The following technical information is retrieved from the *Final Consolidated Basic Project*[8] (**PBC** from the Portuguese "Projeto Básico Consolidado"), approved by the *Brazilian Electricity Regulatory Agency* (**ANEEL** from the Portuguese, "Agência Nacional de Energia Elétrica") on 26 August 2011[3]. Still, it shall be clear that during the construction the project and, consequently, some technical specifications, may suffer small changes.

[8] UHE Teles Pires. Projeto Básico Consolidado, Relatório Final (Agosto 2011).

The facility consists of a power house totalizing 1,820 MW of installed capacity with 5 turbine generator sets. The total firm energy of the plant is 940.6 $MW_{average}$/year. Therefore, the ex-ante estimated plant load factor[9] - defined as the ratio between the assured energy and total installed capacity of the plant - is roughly 0.517[10]. The main characteristics of the Project are, as explicated in the *Final Consolidated Basic Project*, the following:

- Total installed capacity = 1,820 MW
- Total firm energy = 940.6 MW_{avg}
- Nominal generator power = 404.45 kVA
- Turbine type = Francis
- Nominal Power of each unit (turbine) = 369.70 MW
- Number of generation units = 5
- Reference net head = 52.2 m
- Weighted average efficiency of the turbine = 93.68%
- Weighted average efficiency (turbine+generator) = 92.10%
- Nominal flow per unit = 782.52 m^3/s
- Maximum-maximorum reservoir level[11] = 220 m
- Reservoir area at maximum level (220 m) = 135.4654 km^2
- River bed area = 40.6 km^2

The project's reservoir area under the normal maximum water level of 220 m is 135.4654 km^2, of which 40.6 km² is part of the normal river bed and, therefore, the increased flooded area is 94.8654 km². According to a clarification approved by the CDM EB[12], "in order to calculate power density, the correct equation will be the increased power capacity divided by the increased flooded area measured in the water surface". Therefore, the power density of the project activity is roughly 19.18 W/m².

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

Table 2 - Project emission reductions over the crediting period

[9] Following the requirements of the "*Guidelines for the reporting and validation of plant load factors*" (version 1, EB48), the load factor of the UHE Teles Pires was defined *ex-ante* considering the value that was approved by a third party, namely, the Brazilian Electricity Regulatory Agency.
[10] PLF = 940.6 ÷ 1,820 = 0.5168
[11] ANEEL Ficha Resumo – Estudos de viabilidade e projeto básico (Abril/2008).
[12] AM_CLA_0049 available at http://cdm.unfccc.int/methodologies/DB/AS1DOF3L010BY57ZT2UZNQ8Y9K83CN/view.html

Years	Annual estimation of emission reductions in tonnes of CO_2e
2015	2,488,762
2016	2,495,580
2017	2,488,762
2018	2,488,762
2019	2,488,762
2020	2,495,580
2021	2,488,762
2022	2,488,762
2023	2,488,762
2024	2,561,145
Total estimated reductions (tonnes of CO_2e)	24,973,637
Total number of crediting years	10
Annual average over the crediting period of	2,497,364

Please refer to Section B.6.3 and the CER calculation spreadsheet (appendix 3 to the PDD) for further details on the quantification of GHG emission reductions associated with the Project. The spreadsheet with the CER calculation is part of the PDD.

A.4.5. Public funding of the project activity:

No official development assistance or related public funding was or will be used in *Teles Pires Hydropower Plant Project Activity*.

SECTION B. Application of a baseline and monitoring methodology

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

1. ACM0002 - Consolidated methodology for grid-connected electricity generation from renewable sources, version 12.2.0;
2. Tool for demonstration and assessment of additionality, version 06.0.0;
3. Tool to calculate the emission factor for an electricity system, Version 2.2.1.

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

The applicability conditions of ACM0002 are all fulfilled by the proposed project activity as further detailed below.

- *The 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 proposed project activity comprises the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).

- *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;*

The proposed project activity is the installation of a new hydro power plant.

- *In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 11 to calculate the parameter $EG_{PJ,y}$): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;*

Not applicable. The proposed project activity does not correspond to a capacity addition, retrofit or replacement.

In case of hydro power plants, one of the following conditions must apply:

- *The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or*
- *The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or*
- *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.*

The implementation of the proposed project activity will result in a new reservoir and the power density is greater than 4 W/m^2.

Finally, the methodology has the following restrictions – i.e. project activities may not be applicable in the following cases:

- *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;*
- *Biomass fired power plants;*
- *Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m2.*

The project is still applicable for the use of ACM0002 since it does not correspond to any of the restrictions listed above. In addition to the applicability conditions of the ACM0002 methodology, the applicability conditions of the tools used must also be assessed.

In order to estimate the baseline emissions occurring after the implementation of the proposed project activity the "*Tool to calculate the emission factor for an electricity system*" is used. This tool provides the steps required to estimate the CO_2 emission factor, which consists of a "*combined margin*", for the displacement of electricity generated by plants connected to an electric grid.

As further described below in section B.6.1, off-grid power plants are not considered. Hence, the requirements of Annex 2 of the tool, referring to the applicability conditions that shall be met when this kind of plants are considered, is not applicable. Besides, the Brazilian Electric System is neither partially nor totally located in any Annex-I country.

In this sense, it can be concluded that there are no applicability conditions preventing the use of this tool to estimate the CO_2 emission factor of the Brazilian Electricity System in the context of the proposed project activity.

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

The project boundary is defined by the emissions targeted or directly affected by the project activities, construction and operation. It encompasses the physical, geographical site of the hydropower generation source, which is represented by the respective river basin of the project close to the power plant facility, as well as the interconnected grid (Figure 2). On May 26th, 2008, the Brazilian Designated

Authority published Resolution number 8 defining the Brazilian Interconnected Grid as a single system comprising the fifth regions of the country[13].

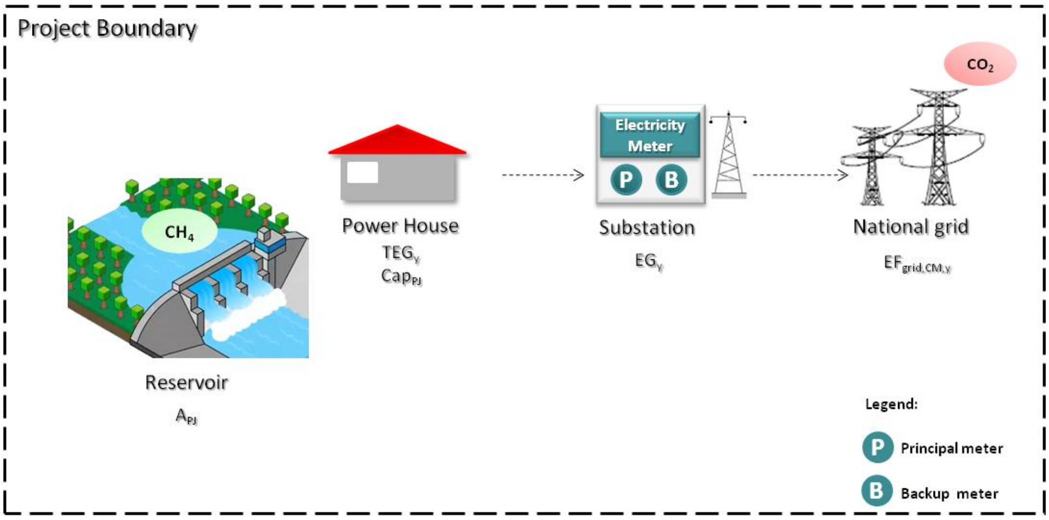

Figure 2 - Project Boundary of the project activity.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the below table.

Table 3 - Emission sources and gases related to the project activity

Source		Gás	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	Emission of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	Yes	Main emission source. Emissions from reservoir are accounted as project emissions once power density of the plant is between 4 and 10 W/m^2
		N_2O	No	Minor emission source

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

The project activity is the installation of a new grid-connected renewable power plant. Hence, accordingly to ACM0002 the baseline scenario is the following:

"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as

[13] CIMGC's Resolution nr 8 from May 26th, 2008 available at: <http://www.mct.gov.br/upd_blob/0024/24719.pdf>.

reflected in the combined margin (CM) calculations as described in the "Tool to calculate the emission factor for an electricity system".

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

The identified starting date of the proposed project activity is 19 August 2011, which is the date of the EPC contract.

In accordance with the "Guidelines in the demonstration and assessment of prior consideration of the CDM" (Annex 13, EB62), for projects activities with a starting date on or after 02 August 2008, Project Participants must notify the host country DNA the UNFCCC secretariat of their intention to seek CDM status.

In December 2010, Project Participants have forwarded the Prior Consideration of the CDM Form (F-CDM-Prior consideration) both for the Brazilian Designated National Authority and to UNFCCC secretariat. Copies of the forms as well as the confirmation of receipt by the Brazilian DNA and UNFCCC were presented to the DOE validating the project.

For the purpose of assessing the additionality of the project activity, ACM0002 methodology requires the use of the latest version of the *"Tool for the demonstration and assessment of additionality"* agreed by the CDM Executive Board.

Following are the necessary steps for the demonstration and assessment of the *Teles Pires Hydropower Plant Project Activity* additionality.

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

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

Companhia Hidrelétrica Teles Pires is a SPC set up specifically to construct and operate the UHE[14] Teles Pires.

Ecopart Assessoria em Negócios Empresariais Ltda. is the CDM project developer.

Hence, based on the nature of these companies, namely the project participants, the only realistic and credible alternatives to the project activity identified are:

(a) Alternative 1: The proposed Project activity undertaken without being registered as a CDM project activity;

(b) Alternative 2: Continuation of the current situation, i.e. electricity will continue to be generated by the existing generation mix operating in the grid.

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

Both the project activity and the alternatives scenarios are in compliance with all laws and regulations according the electricity sector relevant entities, namely, *National Electric System Operator*

[14] UHE stands for "Usina Hidro Elétrica" (Hydro Power Plant).

(ONS from the Portuguese "Operador Nacional do Sistema Elétrico", the national dispatch center), ANEEL and, the *Brazilian Institute of Environmental and Renewable Natural Resources* (the federal environmental agency, IBAMA from the Portuguese "Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis").

Outcome of step 1b: Both identified realistic and credible alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations, taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis)

PPs will apply step 2, investment analysis.

Step 2. Investment analysis

Determine whether the proposed project activity is not:

(a) The most economically or financially attractive; or

(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).

Sub-step 2a. Determine appropriate analysis method

According to the "Tool for the demonstration and assessment of additionality", three options can be applied to conduct the investment analysis. These are "Simple Cost Analysis" (Option I), "Investment Comparison Analysis" (Option II), and "Benchmark Analysis" (Option III). The additionality of the Project is assessed and demonstrated by means of an investment benchmark analysis; option III.

Options I and II are not applicable to the proposed project activity since:

- Option I – both the CDM project activity and the alternatives identified generate financial and economic benefits other than CDM related income.
- Option II – the implementation of other project types of renewable energy generation – e.g. cogeneration or small hydro power plant projects - are not potential alternatives in the site where the project is planned.

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

The most suitable and widely used financial indicator for the benchmark analysis is the Internal Rate of Return (IRR). The IRR is the annualized effective compounded return rate which can be earned on the invested capital, i.e., the yield on the investment. In other words, it is the precise discount rate that makes the present value of the future cash returns from a capital investment exactly equal to the initial amount of capital invested. If IRR is higher than the benchmark, the investment is an attractive opportunity; if less, the investment is substandard from the cost-of capital point of view.

Naturally, investors are typically looking for a constant and secure return on their investment, consequently when investing in a different activity (sector) such as renewable energy generation; a higher return rate is expected because of all involved risks.

The World Bank published a report in 2008[15] stating that *"The combination of regulatory uncertainties arising from the environmental legal framework and (to a lesser extent) from the legal framework governing the energy sector, represents substantial risks for potential investors. Investors are obliged to put a price on this risk and pass on the costs to consumers. The Brazilian Electricity Regulator (ANEEL) estimates that investors are prepared to invest in electricity generation only when rates of return are approximately 15%"*.

Furthermore, ANEEL also calculated an adequate return on capital investments in the Brazilian electricity distribution sector as described in their technical report in 2008[16] through which evaluated that the cost of equity for investing in the energy distribution sector should be 13.75% in real terms. According to IPEA[17], the current methodology adopted by ANEEL to estimate the rate of return (cost of capital) should be modified by adding the country risk, exchange rate risk and regulatory risk in order to estimate a more proper return. Based on that, the expected return on equity in real terms should range between 13.4 and 15.4%[18] in the Host Countries energy sector.

Another suitable Benchmark is calculated applying the *Weighted Average Cost of Capital* (WACC) for the power generation sector in Brazil.

$$WACC = Wd \times Kd + We \times Ke$$

We and **Wd** are, respectively, the weights of equity and debt typically observed at the sector. Applied **We** is of 50.00%, and **Wd** of 50.00%. These numbers derive from the typical leverage of similar projects in the sector in Brazil, based on the rules for available long term loans from Brazilian Development Bank (BNDES - from the Portuguese Banco Nacional de Desenvolvimento Econômico e Social). BNDES is the major provider of long-term loans in the country; it supplies the financing for small to large scale projects. Long-term loans are scarcely provided by commercial banks, and in general, these entities do not have competitive rates compared to the BNDES.

Usually, for alternative energy generating project, BNDES finances up to 80% of the items eligible for financing[19]. Considering the total investment necessary to build a plant, it can be assumed that approximately *70% of the project is financed*. Therefore, the 70% percentage corresponds to the Initial Debt/Equity ratio for the energy generation companies, which is the portion disbursed by the bank to the investor and paid on the beginning of the project.

Nevertheless, for the WACC calculation it should be considered the Long-term Debt/Equity structure, which considers not only the debt/equity ratio in the beginning of the project but also how this structure is expected to vary during the project. As a consequence of using the long term debt/equity structure, the 70% proportion decreases with the duration of the project.

In general, the investor has a grace period before starting to pay the amortization and, at the same time, receives all the financing from BNDES on the beginning of the project. For the remaining time, the investor does not receive additional financing (debt proportion decreases), while investor starts to pay the

[15] Environmental Licensing for Hydroelectric Projects in Brazil: A Contribution to the Debate, Volume I, Summary Report, 2008. Available at: http://siteresources.worldbank.org/EXTWAT/Resources/4602122-1214578930250/Summary_Report.pdf

[16] According to the technical note N°68/2007 published by ANEEL para.108 Available at: http://www.aneel.gov.br/aplicacoes/audiencia/arquivo/2006/008/resultado/nota_tecnica_n%C2%BA_68-2007_wacc.pdf

[17] IPEA (Instituto de Pesquisa Econômica Aplicada - Governmental Institute for Economic Research) is a public foundation associated to the Secretariat for Strategic Affairs of the Presidency and is responsible for providing technical and institutional support to the government.

[18] Custo de capital das concessionárias de distribuição de energia elétrica no processo de revisão tarifária, April 2006. Available at: http://desafios.ipea.gov.br/pub/td/2006/td_1174.pdf

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

amortization from the financing with his equity capital (equity proportion increases), increasing the ratio between Equity/Debt until there is no Debt in the 16th years of the BNDES funding period. This rationale is illustrated using a hypothetical example in the below figure and the Net Present Value of the Debt and Equity are calculated to consider the entire project on the same date.

Total Investment ($)	500.000
BNDES Tranche	70%
Amortization (years)	16
Inflation	5,00%

	Year 0	Year 1	Year 2	Year 3	...	Year 17	Year 18	Year 19	Year 20
Debt		350.000	0	0	...	0	0	0	0
Equity	150.000		21.875	21.875	...	21.875	0	0	0
Debt/Equity		70%	0%	0%	...	0%	0%	0%	0%
Equity/Debt		30%	100%	100%	...	100%	0%	0%	0%

Debt Net Present Value	333.333
Equity Net Present Value	387.076
Debt/Equity ratio	46%

Figure 3: Hypothetical example for the Long term Debt/Equity structure

Despite of the explanation provided above, this information is not readily available for similar project being developed in Brazil. Then, in accordance with paragraph 18, Annex 5, EB62, 50% debt (Wd) and 50% (We) equity are assumed as a default value.

Kd is the cost of debt, which is observed in the market related to the project activity, and which already accounts for the tax benefits of contracting debts. This parameter is calculated through the following equation: [1 + (a+b+c) x (1-t)]/ [(1+d) -1].

Table 4: Cost of debt (Kd) calculation

Cost of Debt (Kd)	
(a) Financial cost[20]	6.53%
(b) BNDES fee[21]	0.90%
(c) Spread[21]	2.50%
(a+b+c) Pre-Cost of Debt	9.93%
(t) Marginal tax rate[22]	34.00%
(d) Inflation forecast[23]	4.50%

[20] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Custos_Financeiros/Taxa_de_Juros_de_Longo_Prazo_TJLP/index.html.
[21] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/meio_ambiente.html
[22] http://www.receita.fazenda.gov.br/Aliquotas/ContribCsll/Aliquotas.htm http://www.receita.fazenda.gov.br/Aliquotas/ContribPj.htm
[23] http://www.bcb.gov.br/pec/metas/InflationTargetingTable.pdf

After tax Cost of Debt (p.a.)	1.96%

According to the table above, **Kd** is of 1.96%.

Ke is the cost of equity and represents the rate of return for equity investments and is estimated through the equation: [1 + (Rf + (β x Rm) + Rc)] x (1 + π) / (1+ π')].

Table 5: Cost of equity (Ke) calculation

Cost of Equity (Ke)	
(Rf) Risk-free rate[24]	4.25%
(Rm) Equity risk premium[25]	6.03%
(Rc) Estimated country risk premium[26]	2.45%
(β) Sectoral Risk[27]	1.29
(I) US expected inflation[28]	1.98%
Cost of Equity with Brazilian Country Risk (p.a.)	12.46%

In line with the table above, Ke is of 12.46%. As can be seen, Ke derives from a risk free rate plus the market risk premium adjusted to the sector through Beta (β).

Plugging these numbers into WACC formulae:

WACC = 50.00% x 1.96% + 50.00% x 12.46% = 7.21%

All information used in the calculation of the benchmark is fully reference in the WACC calculation spreadsheet (Appendix 1 to the PDD). The spreadsheet with the WACC calculation is part of the PDD.

All above mentioned benchmarks, substantiated by a third party / independent sources, are suitable to investments in the Brazilian electricity sector and, are in accordance with the date on which the decision to invest in the project was taken. Most importantly, all data comply with the requirements set out in the "Tool for the Demonstration and Assessment of Additionality" and "Guidance on the Assessment of Investment Analysis". Thus, the project participants select the most conservative benchmark applicable to the project activity which corresponds to WACC of 7.21%.

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

As mentioned above, the financial indicator identified shall be the Internal Rate of Return (IRR), which can be the Project IRR or the Equity IRR. The Project IRR can be compared with the WACC as the Equity IRR with the Return on Equity (Ke)[29].

[24] http://pages.stern.nyu.edu/~adamodar/
[25] http://pages.stern.nyu.edu/~adamodar/
[26] http://www.cbonds.info/all/eng/index/index_detail/group_id/1/
[27] http://pages.stern.nyu.edu/~adamodar/
[28] http://www.federalreserve.gov/econresdata/researchdata.htm
[29] Guidance 12, Annex 5, EB 62.

below provides a list with key input values in the IRR calculation as well as a brief justification for their use. All information used in the calculation of the rate is fully reference in the IRR calculation spreadsheet (Appendix 2 to the PDD). The spreadsheet with the IRR calculation is part of the PDD.

Table 6 - IRR calculation key input values

Parameter	**Value**	**Source**
Generation Characteristics		
Installed capacity (MW)	1820	PBC[8]
Forecasted firm energy (MW_{avg})	940.6	PBC[8]
Forecasted gross annual power generation (MWh)	8,239,656	Calculated[30]
Internal Energy Consumption (%)	0.2	CCEE (Commercialization Rules – Module 2)[31]
Investments, Operational Expenses and Sectoral Tariffs		
Total investment – CAPEX (thousand R$)	3,587,628	EPC Contract
O&M (R$)	227,845,256.403	Teles Pires Budget (Custos_estrutura Teles Pires.xls)
TUST (R$/KW month)	IRR calculation spreadsheet	ANEEL through the Ratifying Resolution N°1,086
UBP	5,515	Finance request report submitted to the Brazilian Development Bank[32]
TFSEE (%)	0.50	ANEEL[33]
Royalties (%)	6.75	
ONS (%)	0.04	ANEEL Resolution N°328/04[34]
P&D (% of net operational revenues)	1.00	Art. n°2 of Law n° 9.991/00[35]
Applicable Taxes		
Income tax (%)	25	Art. n°2 of Law n° 9.430/96[36]
PIS (%)	1.65	Art. n°2 of Law n° 10.637/02[37]

[30] The expected gross annual power supplied to the gird was calculated based on the forecasted guaranteed energy generation multiplied by the number of hours (8760) in a given calendar year. In order to obtain the amount of net forecasted power supplied to the grid, the plants own consumption is subtracted from the gross generated energy.
[31] Calculated based on "Commercialization Rules – Module 2 " Available at: http://www.ccee.org.br/StaticFile/Arquivo/biblioteca_virtual/Regras/explicativo_09_2.pdf
[32] Consulta prévia para enquadramento UHE Teles Pires. Março de 2011.
[33] Please refer to section B.5, sub-step 2d-Sensitivity Analysis for a detailed description of each tariff and its respective source.
[34] Available at: http://www.aneel.gov.br/cedoc/rea2004328.pdf
[35] Available at: http://www.planalto.gov.br/ccivil_03/Leis/L9991.htm
[36] Available at: http://www.normaslegais.com.br/legislacao/tributario/lei9430.htm
[37] Available at: http://www.receita.fazenda.gov.br/Legislacao/Leis/2002/lei10637.htm

COFINS (%)		7.6	Law n° 9.718/98[38]
CS (%)		9	Art n°3 of Law n° 7.689/88[39]
Power Purchase Agreements (PPA's)			
Electricity tariff, (R$/MWh)	ACR (70%)	58.35	Finance request report submitted to the Brazilian Development Bank
	ACL	145	Finance request report submitted to the Brazilian Development Bank
Others			
Depreciation		10/25 years	Equipments/civil works (ANEEL[40])

The IRR of the project calculated using the assumption presented above shows that without considering CERs revenues is 2.43%, significantly lower than the chosen benchmark, WACC of the sector of 7.21%. The result clearly demonstrates that the project activity has a less favorable indicator than the benchmark and cannot be considered as financially attractive.

Sub-step 2d: Sensitivity analysis

The sensitivity analysis, as established by the "*Guidance on the Assessment of Investment Analysis*", is to be conducted considering variables that constitute more than 20% of either total project costs or total project revenues, including initial investment costs. Hence, variations will be done by altering the following parameter:

- Reducing investment expenses (investment costs).
- Increasing project's revenues (electricity tariff);
- Increasing energy generation by the plant (power generation);
- Reducing cost of operational (total operating costs)

Financial analyses were performed altering each of these parameters by 10%, as well as the variation needed to reach the benchmark, and assessing what was the impact on project's IRR (guidance 21, EB62, Annex 5). The result is presented below in Table 7.

Table 7 – Sensitivity analysis

	IRR with 10% variation	Variation to reach the benchmark
Original value	2.43%	n.a.
Investment costs	3.34%	39%
Electricity tariff	4.10%	31%
Power generation	5.58%	16%

[38] Available at: http://www.normaslegais.com.br/legislacao/tributario/lei9718.htm
[39] Available at: http://www.planalto.gov.br/ccivil_03/Leis/L7689.htm
[40] For each specific depreciation rate please refer to the Projects Financial Analysis' Fixed Assets ANEEL tab.

Total operating costs	3.34%	57%

In the next paragraphs it is discussed why these variations do not reflect a realistic range of assumptions for the input parameters of the financial analysis.

Investment costs: A decrease of 39% in investment costs is very unlikely to happen, as it is much more likely that hydropower projects will rather experience cost increases during construction. The total investment necessary to build the plant as it is presented in the cash flow corresponds to the estimated investment cost made by the project owner. Specifically for the Project the PPs will sign an EPC contract, which can be used to confirm preliminary estimations. This type of contract fixes the price to build the plant and any variation either in favor or against the project is in charge of the construction company which means that no variation in project IRR can be reasonably attributed to a variation in the investment costs.

The conclusion is backed up by peer-review literature findings related to the estimation of construction costs and schedules in developing countries. Using a sample of 125 projects (59 thermal and 66 hydropower) Bacon and Besant-Jones (1998)[41] show that although the ratio of actual to estimated cost can be smaller than one (indicating actual investment smaller than estimated), less than 10% of the analysed projects disbursed less than forecasted. One of the conclusions of the paper is that "the estimated values were significantly biased below actual values".

From the above information the PPs are confident to state that a reduction in the project activity investment expenses in very unlikely and a reduction of 39% in investments costs is not possible.

Electricity tariff: The electricity tariff of the Project was established by the energy auction carried out by the *Chamber of Electric Energy Commercialization* (CCEE from the Portuguese "Câmera de Comercialização de Energia Elétrica") on December 17th, 2010[42]. The value of the electricity tariff was fixed at R$58.35[43] for a term of 30 years (initiating on 1 January 2015) which will be commercialized in the Regulated Contracting Environment (ACR). According to the auction notice, 85% of the forecasted annual power supply to the grid[44] at the time of the auction has to be commercialized in the ACR. The remaining energy can thus be commercialized in the Free Contracting Environment (ACL), here at an estimated price of R$145. Since the tariff for the ACR is fixed, a variation of 31% in total revenues from the electricity sales in the ACL, which corresponds to a significant smaller share of the forecasted power generation, is required to reach the benchmark, clearly not a plausible scenario.

Annual power supplied to the grid: The expected annual power supplied to the grid by the Project as established by the Mines and Energy Ministry (Ordinance MME n°27/2010) is calculated based long-term historical hydrological data (available since 1930s) and therefore the long term average annual power supplied is unlikely to be significantly different to the value used in the financial analysis.

[41] R. W. Bacon and J. E. Besant Jones (1998). *Estimating construction costs and schedules – Experience with power generation projects in developing countries.* Energy Policy, vol. 26, no 4, pp 317-333.
[42] MME Portaria 820 de 4 de outubro de 2010 (retrieved from www.aneel.gov.br/cedoc/prt2010820mme.pdf on 11 November 2011).
[43] Resultados do 11º Leilão de Energia Nova - Resumo Vendedor - Edital 04/2010 ANEEL - Empreendimento Hidro 2015-H30 (retrieved from http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=9f57fa604f1bb210VgnVCM1000005e01010aRCRD&vgnextfmt=default on 11 November 2011).
[44] ANEEL - Edital Leilão N°04/2010, Anexo VIII.

The Brazilian electricity model defines that electric energy commercialization is performed in two market environments, the *Regulated Contracting Environment* (**ACR**[45]) and the *Free Contracting Environment* (**ACL**[46]).

In the ACR, electric energy sellers and distributors can participate through public auctions regulated by ANEEL and made operational by CCEE. In order to ensure the compliance with the market demand, the distribution agents can acquire energy in accordance with article 13 of Decree N°5.163/2004:

- Electric energy purchase auctions from existing and new generation plants;
- Distributed generation, as long as the contracting (hiring) is preceded by a public call made by the distribution agent and limited by an amount of 10% of the distributors market;
- Plants that generate electric energy from wind, small hydropower and biomass plants that were contracted in the first stage of the *Alternative Energy Sources incentive Program*[47] and;
- Bi-national Itaipu Hydropower plant.

In the Free Contracting Environment, generation and commercialization agents as well as electric energy importers, exporters and free consumers can participate. In this environment electric energy purchase and selling volumes as well as their price can be freely negotiated through bilateral contracts. Additionally to the existence of two commercialization environments as explained above, a short-term market (administrated by CCEE) where the difference between the generated/consumed physical energy and contracted energy are accounted for and liquidated. Participation is compulsory for generators, distributors, importers, exporters, traders and free consumers connected to the SIN. The market price used in the short term market is denominated *Settlement Price Difference* (**PLD**, from the Portuguese "Preço de Liquidação das Diferenças"). The PLD is calculated based on the predominance of hydroelectric generation, which aims to find the optimal balance between the present benefit of using hydroelectric resources (water) and storing it, measured in terms of the expected fuel oil savings consumed by thermoelectric plants. Therefore, based on hydrological conditions, energy demand, fuel prices, deficit cost, operation start of new projects and availability of generation and transmission equipments, the pricing model obtains the optimal dispatch for a given period, defining the hydraulic and thermal generation for each sub-market.

In order to share and mitigate the hydrological risks associated with the centralized dispatch and optimization of the hydrothermal system by ONS, the *Reallocation Energy Mechanism* (**MRE** from the Portuguese "Mecanismo de Realocação de Energia") is used. The objective is to ensure that all plants that are part of the MRE receive their levels of physical guarantee regardless of their level of energy generation, provided that the total generation of the MRE is not below the total physical guarantee of the system. This means that the MRE reallocates energy by transferring the surplus from those that produced beyond their physical guarantee to those that generated less. In other words, the intention of the MRE is to assure that all generators commercialize the guaranteed energy assigned to them independently from their real energy generation.

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[45] Regulated Contracting Environment (**ACR** from the Portuguese "Ambiente de Contratação Regulada"), official definition available at: http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=fbcca5c1de88a010VgnVCM100000aa01a8c0RCRD

[46] Free Contracting Environment (**ACL** from the Portuguese "Ambiente de Contratação Livre "), official definition available at: http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=84dca5c1de88a010VgnVCM100000aa01a8c0RCRD

[47] PROINFA, from the Portuguese "Programa de Incentivo as Fontes Alternativas de Energia Eletrica".

The reallocation/transfer of energy between hydro's incurs in the cost called "minimum water cost" which is based on an optimization tariff determined by ANEEL to cover the incremental cost incurred in the operation and maintenance of the plant, payment of a financial tariff compensation fee of hydrological resources used which is calculated based on the amount of energy generated. Whenever attributed energy of a generator after being reallocated in the MRE is higher than the contracted one, the generator is entitled to sell this surplus in the short term market at the momentary PLD value. The same applies in the opposite situation, in which the generator will have to purchase energy from the short term market if they don't comply with their contractual obligations (energy generation deficit). Consequently, this means that if a plant generates more energy and it is reallocated in the MRE, the compensation fee the plant receives will not generate any additional revenues, but only cover the cost (O&M) of its additional generation.

Moreover, being UHE Teles Pires defined by ANEEL as a participant in the apportionment of the losses which occur within the basic network, these losses should have been considered. As per the sector regulation, UHE Teles Pires is only allowed to negotiate a quantity of electricity already discounting these losses.

The proposed project activity is contractually bound to sell 85% of its assured energy in the ACR market at a fixed price as determined by the energy auction and the rest, minus losses, to the ACL market. It is relevant to mention that the figure used in the financial analysis already take into account an optimization of the hydropower potential of the plant, which increased the firm energy of the plant by 2.75% from 915.4 MW_{avg} at the time of the auction to 940.6 MW_{avg}. Based on the aforementioned, assuming a consistent increase of 16% in the long term average annual power supplied to the grid is definitely not possible.

Total operating costs: The results of the sensitivity analysis shows that if the Project incurred a reduction of 57% of the operating costs the IRR of the Project would reach the 7.21% benchmark. This is not a plausible scenario and, in the following paragraphs a few reasons are disclosed to confirm the appropriateness of the assumed operation costs.

The following tariffs are part of the operating costs as described below:

I. "TUST" is the tariff for the use of electric energy transmission lines which was fixed by ANEEL until 2021[48];

Table 8 - Annual ANEEL TUST tariff evolution

Period	TUST Tariff R$ kW/month
Jul/14 - Jun/15	9.070
Jul/15 - Jun/16	8.849
Jul/16 - Jun/17	8.628
Jul/17 - Jun/18	8.407
Jul/18 - Jun/19	8.186
Jul/19 - Jun/20	8.186

[48] The transmission lines usage tariff was established by ANEEL (Resolução Homologatória °1086, de 16 de novembro de 2010).

Jul/20 - Jun/21	8.186
Jul/21 - Jun/22	8.186
Jul/22 - Jun/23	8.186
Jul/23 - Jun/24	8.186

II. "UBP" is the tariff for the use of a public good which was determined by the Auction Notice[49] and consists of an annual value of R$ 5,514,831.81.

III. "TFSEE" is a inspections tariff charged by ANEEL which as demonstrated in the Table 9 below has been constantly increasing;

Table 9 - Annual ANEEL inspection tariff evolution[50]

Year	TFSEE Tarrif R$/ kW
2011	385.73
2010	363.60
2009	335.42
2008	303.78
2007	289.22

IV. "Royalties" are considered the financial compensation for the hydrological exploitation of water resources and are established as 6.75% of effective measured generated electric energy[51]. This value is fixed by ANEEL according to the Federal constitution, article 20 which defines potential hydrological resources as a property of the Union and therefore establishes that a financial compensation for its exploitation is required.

V. "TAR" represents the updated Reference Tariff[52] and is one parameter that is used to calculate the financial compensation mentioned in item IV. This tariff is fixed by ANEEL and revised every four years, but updated annually as demonstrated in Table 10 below.

Table 10 - Reference tariff price evolution

Year	Determined by Resolution	TAR tariff value (R$)
2011	ANEEL N° 1096, 14.12.2010	68.34
2010	ANEEL N° 917, 08.12.2009	64.69
2009	ANEEL N° 753, 16.12.2008	62.33
2008	ANEEL N°586, 11.12.2007	60.04
2007	ANEEL N°404, 12.12.2006	57.63

[49] ANEEL, Edital Leilão n°04/2010 – Anexo 9 – Instrumentos e parâmetros.
[50] ANEEL, Despacho Nº 360 de 4 de Fevereiro de 2011.
[51] ANEEL (2005). Atlas da Energia Elétrica do Brasil (2ª edição). Compensação Financeira e Royalties (available at http://www.aneel.gov.br/aplicacoes/atlas/energia_hidraulica/4_11.htm, retrieved on 11 November 2011).
[52] Available at: http://www.aneel.gov.br/area.cfm?idArea=536

2006	ANEEL N°192, 19.12.2005	55.94
2005	ANEEL N°285, 23.12.2004	52.67
2004	ANEEL N°647, 08.12.2003	44.20
2003	ANEEL N°797, 26.12.2002	39.43

VI. "ONS" tariff refers to the reimbursement of part of the administration and operation costs of ONS applied to all generation, transmission and distribution agents as well as free consumers that are connected to the national grid[53].

VII. P&D (Research & Development) tariff corresponds to at least 1% of each independent energy generator net income as determined by Article N°2 of Law N°9.991 dated on July 24th, 2000[54].

Operation and maintenance costs are contractually established between the project developer and the service provider at a fixed rate. Furthermore, all applicable tariffs as described and demonstrated above are determined by specific national entities and a decrease in operating costs/tariffs is very unlikely to happen; more importantly, it's more realistic to expect an increase as demonstrated above. Additionally, all prices are corrected based on the annual inflation rate. Therefore, no significant decrease of the O&M costs can be reasonably expected.

These results clearly show that only under very unrealistic and highly favorable circumstances it would be possible to reach the Project IRR benchmark. We can conclude that the IRR is lower than the benchmark for a realistic range of assumptions for the key input parameters and therefore, that the Project is not financially attractive.

Outcome of sub-step 2d

The IRR of the project activity without being registered as a CDM project is significantly below the sector benchmark, demonstrating that project activity is not financially attractive to investors. Then, alternative scenario 2 would be the most plausible alternative to the project activity, *i.e.* the continuation of the current situation with additional electricity supplied by the Brazilian Interconnected Grid.

Step 3. Barrier analysis

Not applicable.

Step 4. Common practice analysis

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

According to the additionality tool, "projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc". Also in accordance with the additionality tool, other CDM project activities[55], if any, will not be included in the analysis.

[53] ANEEL Resolução Autorizativa 328, de 12 de agosto de 2004.
[54] Lei 9.991 de 24 de julho de 2000.
[55] Registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process.

The following criteria are considered in order to define which projects can be considered similar to UHE Teles Pires.

Country/region: Brazil has an extension of 8,514,876.599 square kilometres[56] (with over 4,000 km distance in the north-south as well as in the east-west axis) and 6 distinct climate regions: sub-tropical, semi-arid, equatorial, tropical, highland-tropical and Atlantic-tropical (humid tropical). These varieties of climate obviously have strong influence in the technical aspects related to a hydropower projects.

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

Scale: According to the Brazilian regulations, large scale hydropower plants are defined as plants with an installed of more than 30 MW[57]. Therefore, no small scale hydropower plant (i.e, installed capacity under 30MW) is considered. Furthermore, the range of analysis equals to ±50% of the installed capacity of the proposed project activity, resulting in a range from 909 to 2730[58] MW.

Same environment with respect to regulatory framework: Until the beginning of the 1990's, the energy sector was composed almost exclusively by state-owned companies. From 1995 onwards, due to the increase in international interest rates and the lack of state investment capacity, the government started the privatization process. However, by the end of 2000 results were still modest. Although further initiatives, aiming to improve electric generation in the country, were taken between the 1990's and 2003, they did not attract enough new investments to the sector.

During 2003 and 2004, the Federal Government announced the new model for the Brazilian Electricity Market sustained by Laws n°10.847 and 10.848 of March 15th, 2004 and Decree n°5.163 of July 30th, 2004. This new model defined the creation of:

- A new institution responsible for the long term planning of the energy sector (Energy Research Company – EPE);
- An institution to evaluate continuously the electric energy supply (Electric Sector Monitoring Committee - CMSE) and;
- An institution to continue performing the activities that were taking care by the Wholesale Electric Energy Market (MAE) related to the commercialization of the interconnected electric energy system.

[56] Available at: http://www.ibge.gov.br/english/geociencias/cartografia/default_territ_area.shtm.
[57] ANEEL – Agência Nacional de Energia Elétrica. Resolution # 652, issued on December 9th, 2003.
[58] This range was deemed acceptable by the Board as per the Request raised by the CDM Executive Board in the context of the request for review of the CDM Project Activity Ref. # 2010. Document is available at < http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218108477.61/Review/0TR4ZO639HTMUB7EMY2AYRD5BSWR0I/display>. Retrieved on 03 October 2011.

According to OECD[59], "Central to the new model is the creation of the 'Pool' (Ambiente de Contratação Regulado, ACR), matching electricity demand and supply capacity through long-term contracts, which will replace on a competitive bases the "initial contracts" inherited from the 1990s. These contracts were designed as a bridge between the 1980s and the new environment after the privatization of most distribution companies and schedule to gradually expire after 2002. The new framework is inspired by the "single-buyer" model, where an entity — typically the government — buys all electricity from producers and sells it to distributors. However, although establishing a common mechanism for the purchase of energy, the model allows market risk to be shared among participants instead of being borne exclusively by the government, which acts rather like an auctioneer than a buyer. With long-term contracts set through the Pool, price uncertainty will be broadly restricted to electricity traded in the free, short-term market and bilateral contracts between generators and large consumers."

A comparison between the old Electricity Markets and its transition to the New Model can be seen in detail in the Table 11[60] below:

Table 11 - Brazilian electricity market development

Old Model (until 1995)	Free Market Model (1995 - 2003)	New Model (2004)
Financing through public resources	Financing through public and private resources	Financing through public and private resources
Vertically Integrated Companies	Companies divided by activity: generation, transmission, distribution and commercialization	Companies divided by activity: generation, transmission, distribution, commercialization, import and export
Predominantly State Owned Companies	Emphasis on privatization and starting new companies	Coexistence between state owned and private companies
Monopolies - Nonexistent competition	Generation and commercialization competition	Generation and commercialization competition
Captive consumers	Free and captive consumers	Free and captive consumers
Regulated tariffs in all segments	Generation and commercialization prices freely negotiated	*Free Environment (ACL):* Generation and commercialization prices freely negotiated *Regulated Environment(ACR):* Auction and bidding for the lowest tariff
Regulated Market	Free Market	Regulated and Free market
Determinative planning: Energy System planning coordinating group	Indicative planning by the National Energy Policy Council	Planned by the Energetic Research Company (EPE)

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59 *Regulation of the Eletricity Sector IN OECD Economic Surveys of Brazil 2005*.

60 Electricity Markets Comparison retrieved on 03 October 2011 from http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=96a0a5c1de88a010VgnVCM100000aa01a8c0RCRD.

Contracting: 100% of the Market	Contracting: 85% of the Market (until august/2003) and 95% (until December/2004)	Contracting: 100% of the Market + reserve
Energy balance surplus / deficit is divided between consumers	Energy balance surplus / deficit is settled by the Wholesale Electric Energy Market (MAE)	Energy balance surplus / deficit are settled by the Electric Energy Commercialization Chamber (CCAA) and through a compensation mechanism (MCSD) for distributors.

Concluding, the Brazilian energy supply crisis originated from the fatigued old state-owned energy model, evolving through a free market until reaching the new, more competitive and more robust actual model. Since the exhaustion of the state-owned models investment capacity was perceived, a fast transition to a private model was attempted. However, this new model was not capable of achieving the required effects and an alternative sectoral model had to be constituted in order to enable a balanced co-existence of public and private capital in a competitive environment.

Taking into account this new regulatory framework, it is clearly only reasonable to consider projects for which the decision making process happened after March of 2004.

On 20 September 2011 a total of 947 hydroelectric plants with a total installed capacity of roughly 81,929 MW were in operation[61].

Applying the installed capacity criteria to the 947 hydroelectric plants connected to the SIN, 803 plants are small scale[62] (installed capacity equal or under 30MW) according to the criteria determined by ANEEL and, therefore, can't be compared to the Project activity. This brings the number of hydroelectric plants down to 144, of which only 20 plants fit the first criteria description as indicated in Table 12.

Table 12 - Identified similar plants

Plant	Installed Capacity (kW)	Operation Start	Power Density (W/m²)	Owner / Type
Paulo Afonso IV	2,462,400	1979	242.4	CHESF/State-owned
Itumbiara	2,080,500	1981	2.66	Furnas/State-owned
São Simão	1,710,000	1978	2.22	CEMIG/State-owned
Bento Munhoz da Rocha Neto	1,676,000	1980	11.32	COPEL/State-owned
Eng° Souza Dias	1,551,200	1974	4.74	CESP/State-owned
Eng° Sérgio Motta	1,540,000	2003	0.538	CESP/State-owned
Luiz Gonzaga	1,479,600	1988	1.77	CHESF/State-owned
Itá	1,450,000	2000	10.2	Private-owned
Marimbondo	1,440,000	1975	3.29	Furnas/State-owned

[61] ANEEL, Generation Database. Available at: http://www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.asp, data retrieved on 20 September 2011.
[62] Definition of small scale hydro projects in Brazil according to the legal definition of the National Electricity Agency (ANEEL), Art. n°3 of Resolution n° 652 dated on December 9th, 2003. Available at: http://www.aneel.gov.br/cedoc/res2003652.pdf

Salto Santiago	1,420,000	1980	6.83	Private-owned
José Ermírio de Moraes	1,396,200	1979	2.16	Private-owned
Serra da Mesa	1,275,000	1998	0.725	Furnas/State-owned
Ney Aminthas de Barros Braga	1,260,000	1992	15.2	COPEL/State-owned
José Richa	1,240,000	1999	10.9	COPEL/State-owned
Furnas	1,216,000	1963	0.876	Furnas/State-owned
Emborcação	1,192,000	1982	2.62	CEMIG/State-owned
Machadinho	1,140,000	2002	20.1	Private-owned
Salto Osório	1,078,000	1975	26.3	Private-owned
Sobradinho	1,050,300	1979	0.249	CHESF/State-owned
Luiz C. Barreto de Carvalho	1,048,000	1969	22.8	Private-owned

From the above it is clear that all (similar by scale) hydro plants included in the common practice analysis started operation before 2004 and, were obviously commissioned before the entry into force of the new model for the Brazilian Electricity Market, i.e., none of the identified projects undergone an auction and bidding for the lowest tariff process.

Based on the aforementioned, there is no project in the same country, and/or relying on a broadly similar technology, are of a similar scale, and taking place in a comparable environment with respect to regulatory framework, investment climate, access to technology, and access to financing, etc. Therefore, the proposed project activity cannot be considered common practice in the host country.

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

Considering the analysis provided in Sub-step 4a, there are no similar options occurring, therefore the proposed project activity cannot be considered common practice.

In conclusion, as Sub-steps 4a and 4b are satisfied, i.e., *(i) similar activities cannot be observed* or (ii) similar activities are observed, but essential distinctions between the project activity and similar activities can reasonably be explained, then the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Project Emissions (PE):

The project emissions are accounted for by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$ **Equation 1**

Where:

PE_y Project emissions in year y (tCO_2e/yr)

$PE_{FF,y}$ Project emissions from fossil fuel consumption in year *y (*tCO_2e/yr)

$PE_{GP,y}$ Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)

$PE_{HP,y}$ Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

According to the methodology, project emissions due to fossil fuel combustion and emissions of non-condensable gases from the operation of geothermal power plants are set to zero for hydropower projects ($PE_{GP,y}$ = $PE_{FF,y}$ = 0).

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

For hydro power project activities that result in a new reservoir:

- the methodology is not applicable id the power density (*PD*) of the project activity is less or equal to 4 W/m^2;
- CH_4 and CO_2 emissions from the reservoir shall be accounted if the power density of the project activity is greater than 4 W/m^2 and less than or equal to 10 W/m^2 and;
- Emissions from water reservoir are set to zero if the power density of the project activity is greater than 10 W/m^2.

The Project power density is 19.18 W/m^2, thus by definition emissions from water reservoir are zero ($PE_{HP,y}$=0).

Baseline Emissions (BE_y):

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:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$ **Equation 2**

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 CO_2 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" (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

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, thus $EG_{PJ,y}$ is calculated according to option (a) Greenfield renewable energy power plants as follows:

$$EG_{PJ,y} = EG_{facility,y}$$ **Equation 3**

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)

Determination of $EF_{grid,CM,y}$

The Project Activity is connected to the Brazilian National Interconnected System (SIN). The grid emission factor is calculated by the Brazilian DNA, according to the "Tool to calculate the emission factor for an electricity system".

Step 1: Identify the relevant electricity system

By means of the Resolution number 8[13], issued on May 26th, 2008, the *Interministerial Commission on Global Climate Change* (CIMGC from the Portuguese "Comissão Interministerial de Mudança Global do Clima"), the Brazilian DNA, delineated the electricity system as the National Interconnected Grid (SIN), for CDM purposes. It covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest) as presented in the figure below.

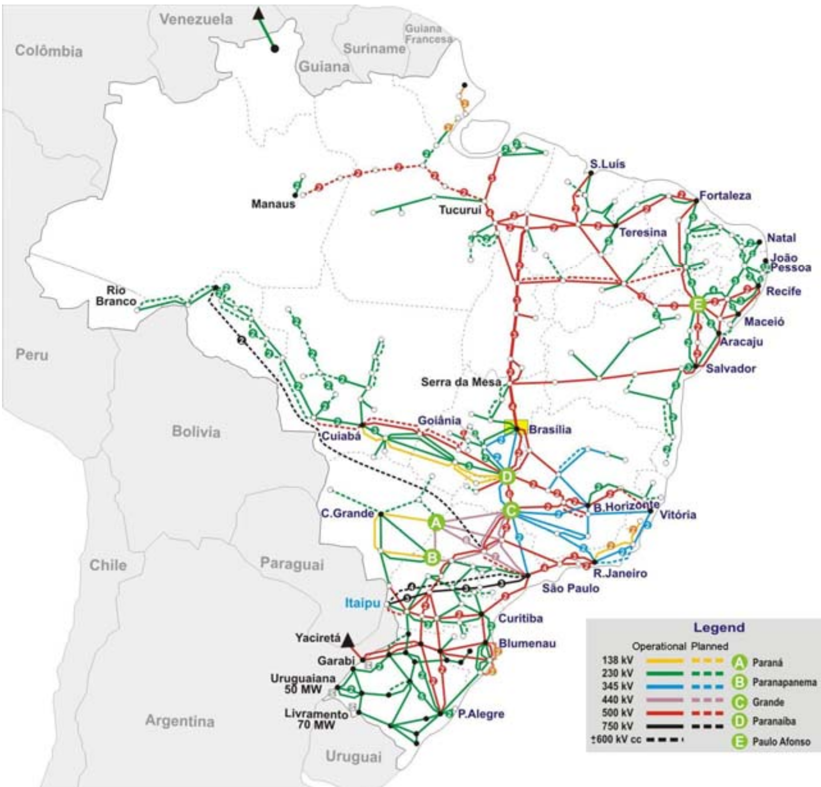

Figure 4 – Brazilian Interconnected System. (Source: ONS)

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

The option chosen to calculate the operating margin and build margin emission factor is Option I: Only grid power plants are included in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is calculated by the Brazilian DNA[63] based on the following method: Option (c): Dispatch data analysis OM

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

The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour h where the project is displacing grid electricity. The emission factor is calculated as follows:

$$EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$ **Equation 4**

Where:

$EF_{grid,OM-DD,y}$	Dispatch data analysis operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{PJ,h}$	Electricity displaced by the project activity in hour *h* of year *y* (MWh)
$EF_{EL,DD,h}$	CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh)
$EG_{PJ,y}$	Total electricity displaced by the project activity in year *y* (MWh)
h	Hours in year *y* in which the project activity is displacing grid electricity
y	Year in which the project activity is displacing grid electricity

Calculation of CO_2 emission factor $EF_{EL,DD,h}$

Project participants do not have access to the Brazilian DNA calculation of the hourly emission factor nor to the spreadsheet used. Only final values are available for public consultation.

Calculation to determine the set of grid power units *n* on top of the dispatch

Project participants do not have access to the Brazilian DNA determination of the set of power units *n* nor to the spreadsheet used. Only final values for the hourly emission factor ($EF_{EL,DD,h}$) are available for public consultation.

Step 5: Indentify the group of power units to be included in the build margin

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

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

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

The option that uses the set of power units that comprises the larger annual generation should be selected. The emission factor is calculated by the Brazilian DNA according to the "Tool to calculate the emission factor for an electricity system" approved by the Executive Board. However, the individual steps used are not publically available.

In terms of vintage of data, project participants chose: option 1 (*ex-ante*).

Step 6: *Calculate* the build margin emission factor

[63] Available at: http://www.mct.gov.br/index.php/content/view/74689.html

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{Equation 5}$$

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)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	Power units included in the build margin
y	Most recent historical year for which power generation data is available

Step 7: Calculate the combined margin emission factor

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} \quad \textbf{Equation 6}$$

Where:

$EF_{grid,CM,y}$	Combined margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh
w_{OM}	Weighting of operating margin emission factor (%)
w_{BM}	Weighting of build margin emission factor (%)

For w_{OM} and w_{BM} the default value of 0.5 is used according to the “Tool to calculate the emission factor for an electricity system”.

Leakage Emissions (L_y)

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, and transport). These emissions sources are neglected.

Emission Reduction (ER_y)

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{Equation 7}$$

Where:

ER_y	Emission reductions in year y ($t\ CO_2/yr$)
BE_y	Baseline emissions in year y ($t\ CO_2/yr$)
PE_y	Project emissions in year y ($t\ CO_2/yr$)

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

This section shall include a compilation of information on the data and parameters that are not monitored throughout the crediting period but that are determined only once and thus remain fixed throughout the crediting period and that are available when validation is undertaken.

Data / Parameter:	w_{OM}
Data unit:	Fraction
Description:	Weighting
Source of data used:	“Tool to calculate the emission factor for an electricity system”
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default weight value for Operating Margin according to the “Tool to calculate the emission factor for an electricity system”
Any comment:	

Data / Parameter:	w_{BM}
Data unit:	Fraction
Description:	Weight
Source of data used:	“Tool to calculate the emission factor for an electricity system”
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default weighting value for Build Margin according to the “Tool to calculate the emission factor for an electricity system”
Any comment:	

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Grid build margin
Value applied:	Brazilian Designated National Authority for the CDM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.1404
Justification of the choice of data or description of measurement methods and procedures actually applied :	BM is calculated according to methodology ACM0002 and the “Tool to calculate the emission factor for an electricity system” by the Brazilian DNA. Project proponents chose Option 2: calculate the build margin emission factor ex-post based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. The Brazilian DNA’s most recent calculation published is based on 2010 data, thus it is used in the PDD.

Any comment:	

Data / Parameter:	***Cap_{BL}***
Data unit:	W
Description:	Installed capacity of the hydro power plant before the implementation of the project activity (W)
Source of data used:	ACM0002
Value applied:	0.0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project consists of a new power plant. As defined in the methodology, for new hydro power plants, this value is zero.
Any comment:	

Data / Parameter:	***A_{BL}***
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full.
Source of data used:	ACM0002
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project consists of a new run of river power plant.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

All equations used to estimate the emission reductions were provided in section B.6.1. Detailed information of how the equations were used, and values applied are provided in the CER calculation spreadsheet (Appendix 3 to the PDD). The spreadsheet with the CER calculation is part of the PDD.

Baseline emissions

As described in section B.6.1, baseline emissions (BE_y) are calculated directly from electricity supplied by the project to the grid ($EG_{PJ,y}$) multiplied by the emission factor ($EF_{grid,CM,y}$).

The estimation of the net electricity generated by the plant, equivalent to the total amount of energy effectively dispatched to the national grid, is based on the assured energy determined for the plant. Additionally, as per article 28 of the Federal Decree[64] nr 5.163/2004, the amount of electricity established in the *Electric Power Commercialization Agreements within the Regulated Ambience* (CCEAR from the Portuguese "Contratos de Comercialização de Energia Elétrica no Ambiente Regulado") must be the

[64] Available in Portuguese at http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/Decreto/D5163.htm.

estimated amount of electricity to be dispatched to the grid at the Gravity Point[65] of the system. Therefore, the transmission losses have to be discounted from the estimated total electricity to be generated by the plant.

The assured energy is equal to 940.6 MWaverage. Transmission losses at the Gravity Point were 2.36%[66]. Assuming that the plant will be operational 8760 hours/year and an internal consumption of 0.2%, the total net energy generated by the plant is 8,028,721 MWh/year.

Additionally, the calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$) follows the steps established in the "*Tool to calculate the emission factor for an electricity system*", as explained above in section B.6.1.

Detailed information of how the equations were used, and values applied are provided in the CER calculation spreadsheet (Appendix 3 to the PDD). The spreadsheet with the CER calculation is part of the PDD. The summary of the results is presented below.

The dispatch data analysis operating margin emission factor is calculated by the Brazilian DNA and made publicly available at http://www.mct.gov.br/index.php/content/view/74689.html. An estimated average operating margin emissions factor for 2010, assuming constant generation throughout the year, is used here for the ex-ante estimation of the emission reductions.

$$EF_{grid,OM-DD,y} = 0.4796 \text{ tCO}_2\text{e/MWh}$$

The build margin emission factor is calculated by the Brazilian DNA and made publicly available at http://www.mct.gov.br/index.php/content/view/74689.html.

$$EF_{grid,BM,y} = 0.1404 \text{ tCO}_2\text{e/MWh}$$

Applying the results presented above in the Equation 6 and considering the weights w_{OM} = 0.5 and w_{OM} = 0.5:

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

$$EF_{grid,CM,y} = 0.5 \times 0.4796 + 0.5 \times 0.1404 = 0.3100 \text{ tCO}_2\text{e/MWh}$$

Finally, baseline emissions can be determined applying the results of $EG_{facility,y}$ and $EF_{grid,CM,y}$ to Equation 2:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

$$EG_{PJ,y} = EG_{facility,y} = 8{,}028{,}721 \text{ MWh/year (when fully operational)}$$

$$BE_y = 8{,}028{,}721 \text{ MWh/year } x \text{ } 0.3100 \text{ tCO}_2\text{/MWh}$$

$$BE_y = 2{,}488{,}762 \text{ tCO}_2\text{/year}$$

Project emissions

The project's reservoir area under the normal maximum water level of 220 m is 135.4654 km^2, of which 40.6 km^2 is part of the normal river bed and, therefore, the increased flooded area is 94.8654 km^2.

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[65] The Gravity Point is the virtual point where the losses of the generation and consumption points become even. At this point all the purchases and sales of electric power at the CCEE are computed. The losses of electric power are shared equally between the points of generation and consumption, where half the losses are deducted from the total amount generated and the other half is added to the total amount consumed (Electric Power Commercialization Chamber (from the Portuguese *Câmara de Comercialização de Energia Elétrica* – CCEE) <www.ccee.org.br>).

[66] Source: CCEE.

With an installed capacity of 1,820 MW, the power density of the project activity is 19.18 W/m² (refer to A.4.3 for the calculation). Therefore, once the project's power density is above 10W/m^2, no calculation of project emissions is required.

Leakage emissions (LE_y)

The calculation of leakage emissions is not required by the methodology.

$$LE_y = 0 \text{ tCO}_2\text{/MWh.}$$

Emission reductions (ER_y)

Applying the results discussed above to Equation 1 one obtains,

$$ER_y = BE_y – PE_y - LE_y$$

$$ER_y = 2{,}488{,}762 – 0 – 0 = 2{,}488{,}762 \text{ tCO}_2\text{/year}$$

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

Table 13 – Emission reductions estimation of the project activity

Years	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2015	0	2,488,762	0	2,488,762
2016	0	2,495,580	0	2,495,580
2017	0	2,488,762	0	2,488,762
2018	0	2,488,762	0	2,488,762
2019	0	2,488,762	0	2,488,762
2020	0	2,495,580	0	2,495,580
2021	0	2,488,762	0	2,488,762
2022	0	2,488,762	0	2,488,762
2023	0	2,488,762	0	2,488,762
2024	0	2,561,145	0	2,561,145
Total (tonnes of CO2e)	0	24,973,637	0	24,973,637

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

B.7.1 Data and parameters monitored:

Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant to the grid in year *y*
Source of data to be used:	Project activity site
Value of data applied for the purpose of	8,028,721

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The measurement of this parameter will be carried out by energy meters installed at the substation in accordance with Module 12 of the Procedures established by the National System Operator – ONS (from the Portuguese *Operador Nacional do Sistema)*.
QA/QC procedures to be applied:	The equipment used to meter electricity production by the plant has by legal requirements extremely low level of uncertainty. Energy will be measured continuously, aggregated each 15 minutes and will be monthly consolidated. Electricity generation by the plant as published by CCEE will be used to cross check project participant's information.
Any comment:	Consolidation reports issued by CCEE already discount losses.

Data / Parameter:	Cap_{PJ}
Data unit:	MW
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Project site.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,820
Description of measurement methods and procedures to be applied:	The installed capacity will be determined based on recognised standards.
QA/QC procedures to be applied:	In Brazil the installed capacity of hydropower plant is determined and authorized by the competent regulatory agency. In addition, any modification also has to be authorized and be publicly available. Hence, on a yearly basis, any new authorization to increase the installed capacity of the plant will be monitored.
Any comment:	

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2/MWh
Description:	Grid operating margin
Source of data used:	Brazilian Designated National Authority for the CDM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.4796
Description of measurement methods and procedures to be applied	OM is calculated according to methodology ACM0002 and the "Tool to calculate the emission factor for an electricity system" by the Brazilian DNA. Project proponents chose Option (c): Dispatch data analysis OM The dispatch data analysis operating margin emission factor is calculated by the Brazilian

	DNA. An estimated average operating margin emissions factor for 2010, assuming constant generation throughout the year, is used here for the ex-ante estimation of the emission reductions. The calculation is also available in appendix 3 to the PDD.
QA/QC procedures to be applied:	
Any comment	

Data / Parameter:	A_{PJ}
Data unit:	km^2
Description:	Area of the reservoir measured on the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data to be used:	Project Developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	94.8654
Description of measurement methods and procedures to be applied:	The project's reservoir area under the normal maximum water level of 220 m is 135.4654 km^2, of which 40.6 km^2 is part of the normal river bed and, therefore, the increased flooded area is 94.8654 km^2.
QA/QC procedures to be applied:	In Brazil, every modification carried out in hydropower plants has to and be made publicly available and authorized by the competent regulatory agency.
Any comment:	

B.7.2 Description of the monitoring plan:

The monitoring plan of the emission reductions by the project activity is in accordance with the procedures set by the methodology ACM0002.

The Project owner will proceed with the necessary monitoring measures as established in the applicable official procedures from ONS, ANEEL and, CCEE.

ONS is the entity responsible for coordinating and controlling the operation of generation and transmission facilities in the SIN under supervision and regulation of ANEEL[67] which is the regulatory agency determining conditions for the electric power market to develop a balance between the agents and the benefit of society[68]. CCEE is a not-for-profit, private, civil organization company that is in charge of carrying out the wholesale transactions and commercialization of electric power within the SIN, for both ACR and ACL[69].

According to the procedures established by ONS, it will be possible to monitor total electricity exported to the grid. Beyond that, energy information will be controlled in real time by CCEE. Once the

[67] Information available at <http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en>.
[68] Information available at <http://www.aneel.gov.br/>.
[69] Information available at <http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=25afa5c1de88a010VgnVCM100000aa01a8c0RCRD>.

measurement points are physically defined and the invoice measurement system and the communication infrastructure are installed, the measurement points will be registered in the SCDE (System of Energy Data collection) managed by CCEE.

There will be at least two energy meters (principal and backup) for which the model and type are specified by ONS. In addition, before the operations start, ONS demands that these meters are calibrated by an entity with Brazilian Calibration Network (RBC form the Portuguese "Rede Brasileira de Calibração") accreditation. According ONS, these meters have to be calibrated every two years after operation start. The SPC responsible for the implementation and operation of the *Teles Pires Hydropower Plant Project Activity* will be responsible for these calibrations. In order to confirm and to give certainty about the energy measurement, it will be controlled in real time by the plant and by CCEE.

Teles Pires Hydropower Plant Project Activity will also be responsible for the maintenance of the equipments' monitoring, for dealing with possible monitoring data adjustments and uncertainties, for review of reported results/data, for internal audits of GHG project compliance with operational requirements and for corrective actions. Yet, it is also responsible for the project management, as well as for organising and training of the staff in the appropriate monitoring, measurement and reporting techniques.

It is important to mention that ANEEL can visit the plant and inspect operation and maintenance of the facilities at any time. Yet, during the periodic verifications, the plant will provide all the necessary documents evidencing the amount of net energy exported to the grid. This data is going to be kept for at least two years after the crediting period ends.

All data collected on-site will be checked internally before being compiled in an electronic format, to ensure that it is complete and of appropriate quality. A final check of the data and project analysis prior to any verification will be carried out.

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)

22/11/2011

The application of the baseline study and monitoring methodology was completed on 22 November 2011. The entity determining the baseline study and the monitoring methodology, participating in the Project as CDM Advisor is EQAO, with the following contact information.

Address: Rua Padre Joao Manoel 222

City: São Paulo

ZIP-code: 01411-000

Country: Brazil

Tel.: +55 (11) 3063-9068

e-mail: eqao@focalpoint.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:

19/08/2011

According to the CDM Glossary of Terms the starting date of a CDM project activity is "*the earliest date at which either the implementation or construction or real action of a project activity begins*". Furthermore the guidance also clarifies that "*the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity (…), for example, the date on which contracts have been signed for equipment or construction/operation services required for the project activity*".

In order to determine the most appropriate starting date, first a timeline of the project activity milestones is presented in Table 14.

Table 14 – Project activity milestones timeline

20 October 2010	EIA-Rima approval (electronic copy submitted to the DOE)
17 November 2010	Auction final rules released[70]
13 December 2010	Preliminary environmental license (electronic copy submitted to the DOE)
17 December 2010	Energy auction[70]
3 February 2011	Finance request submitted BNDES (electronic copy submitted to the DOE)
7 June 2011	Concession contract[71]
19 August 2011	EPC contract (electronic copy submitted to the DOE)
26 August 2011	Basic project design approval[3]

Under the new model of the Brazilian electricity sector, companies willing to get the rights to explore hydroelectric potentials above 30MW have to participate in a public auction which results in the concession to to explore the hydropower potential.

Several necessary steps to build the plant, such as securing finance, signing the power purchase agreement, determining the most appropriate engineering, procurement and construction contract, etc. From the milestones described in Table 14, the first significant financial commitment towards the project construction is the signature of the EPC contract.

Hence, although this event does not represent the financial closure, the companies participating on the SPC committed themselves to the terms of the contract assuming that the project will be built. For that reason the date of the EPC contract, 19/08/2011, is defined as the project starting date.

[70] ANEEL – Edital Leilão 04/2010.
[71] MME – Contrato de concessão nº 02/2011-MME-UHE Teles Pires.

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

35y-0m

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

C.2.1. Renewable crediting period

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

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2015 or on the date of registration, whichever occurs later.

C.2.2.2. Length:

10y-0m

SECTION D. Environmental impacts

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

The decision related to the implementation of a hydroelectric plant is complex and involves a number of governmental and non-governmental agents. The governmental ones are mainly responsible for regulating the electric energy sector, water resource management, control natural resources and soil use. Among non-governmental agents are the ones interested in exploiting the electricity market, investors, product and equipment suppliers, NGO's and the directly and indirectly affected population. Hence, for the implementation of a successful hydropower plant, a consensus between all parties has to be reached, meaning that the following points are met:

- Existent energy demand that justifies the project activity;
- Technical viability for its execution;
- Implementation and operation of the plant lead to reversible impacts and / or are possible to be compensated (counterbalanced);
- Absence of conflicts between the plant's operation and comprehensives area water use;
- Local population can be duly compensated, and;
- Interested agents in constructing and financing the plant.

Additionally, the implementation of a hydroelectric plant has to be in accordance with National Regulations in order to receive all necessary permits to starts is construction and operation. According to Clause 25 by means of item IV of the Brazilian Constitution, the Project entity must elaborate an *environmental impact study* (EIA from the Portuguese "Estudo de Impacto Ambiental") and a corresponding *environmental impact report* (RIMA from the Portuguese "Relatório de Impacto Ambiental") and make them publically available[72] before utilising natural resources and beginning the construction of the project.

Furthermore, normative instruction n°65/2005, through which the *Brazilian Institute of Environmental and Renewable Natural Resources* (the federal environmental agency, IBAMA from the Portuguese "Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis") establishes the procedures required for licensing hydropower plants and Federal Decree n°99274/90, complemented by CONAMA's Resolutions[73] 01/86, 06/86, 06/87, 09/87 and n° 237/97, set forth a three-stage process for the issuing of licenses as follows:

a) A *Preliminary License* (LP from the Portuguese "Licença Prévia") is granted during the preliminary planning stage of a project for a maximum term of five-years. The license approves the location and design of the project, certifies its environmental feasibility and establishes the basic requirements and conditions to be complied with during subsequent implementation stages.

[72] IBAMA – Sistema Informatizado de Licenciamento Ambiental Federal (http://www.ibama.gov.br/licenciamento/).

[73] Brazil's federal environmental entities are the policy-setting *National Environmental Council* (CONAMA from the Portuguese "Conselho Nacional do Meio Ambiente") and the policy-enforcing IBAMA.

b) The *Installation License* (LI from the Portuguese "Licença de Instalação") authorizes the installation of the project activity in accordance with the specifications contained in the approved plans, programs and projects, including environmental mitigation provisions and other conditions.

c) The "Operation License" (LO from the *Portuguese* "Licença de Operação") authorizes operation of the project activity in accordance with environmental mitigation measures and operating requirements. The Operating License can vary from 4-10 years and is renewable within the legal timeframe established by the competent environment agency.

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

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

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

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

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

The plant already possesses the LP and LI[74] issued by IBAMA. Given that, the project does not imply in negative transboundary environmental impacts, on the contrary, otherwise the license would not be issued.

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

The growing global concern regarding the sustainable use of resources is driving a requirement for more sensitive environmental management practices. Increasingly this is being reflected in countries' policies and legislation. In Brazil the situation is no different; environmental rules and licensing process policies are very strict in line with the best international practices.

As mentioned in section D.1, hydropower plants have to do an environmental impact assessment and a respective environmental impact report in order to obtain the necessary licenses to the project.

[74] IBAMA, Licença Prévia 386/2010 e Licença de Instalação 818/2011.

Following the procedures as required by the host Party the federal *Energetic Research Company* (EPE from the Portuguese "Empresa de Planejamento Energético") prepared the *environmental impact study* (EIA) and a corresponding *environmental impact report* (RIMA). The documents were approved by IBAMA on 28 October 2010[75], demonstrating that the identified environmental impacts are not significant.

All the documents related to the environmental impact assessment are publicly available[72], including licenses, official technical opinions, public hearing reports and additional requirements.

In addition, actions to mitigate the impacts caused by construction of the UHE Teles Pires constitute important measures to control the effects directly associated with the project, which will be conducted through the implementation of social and environmental programs. The main objectives of social and environmental programs are to prevent, minimize, compensate, monitor and eventually eliminate negative impacts arising from development in order to maximize the positive impacts, enhancing the beneficial effects of the project.

The proposed programs were developed and targeted to meet a regional level plan in order to prepare the region for receiving the project in a sustainable manner.

The set of socio-environmental programs can be characterized as a management tool that aims to ensure the overall implementation of commitments made by the contractor, with regard to the proper environmental and social management of the enterprise and to comply with the applicable environmental legislation. This set of planned actions, called the Environmental Management Plan was developed through five axis of action, designed to organize the programs to be developed. The following are selected plans included in each line of action.

Axis 1 – Programs directly linked to the construction

- Environmental plan for the construction
- Deforestation and reservoir associated areas cleaning
- Recruitment and demobilization of manpower
- Fish rescue in affected areas

Axis 2 – Monitoring, control, management and conservation plan

- Seismicity monitoring
- River slopes stability and erosion processes monitoring
- Groundwater monitoring
- Seeds and seedlings rescue and implementation of seedling nursery
- Hydro-sedimentary monitoring
- Fauna scientific rescue
- Water limnological and quality monitoring
- Climate monitoring

[75] IBAMA, Parecer 85/2010.

- Fauna monitoring
- Malaria action and control plan
- Cultural historical and archaeological heritage preservation

Axis 3 – Compensatory programs

- Implementation of the reservoir permanent preservation area
- Loss of land and economic activities disruption compensation
- Labor re-insertion and local economic activities support
- Environmental compensation – conservation unit
- Tourism activities support and revitalization
- Social infrastructure strengthening
- Forest restoration

Axis 4 and 5 – Support and special programs

- Social communication
- Environmental education
- Environmental conservation plans and reservoir environs use

More information on each of the above mentioned programs is available in the document "Summary of Social & Environmental Activities of the Basic Environmental Project, UHE Teles Pires – Preventive, Mitigating, Control and Compensatory Measures[76]" (electronic copy submitted to the DOE during the validation process).

SECTION E. Stakeholders' comments

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

According to the federal and local states legislation, the environmental licensing process requests public hearings with the local community.

Three public hearings were carried out in November 2010 in the cities of Paranaita, Alta Floresta and Jacareacanga. Hearing reports are part of the environmental licensing documents publicly available at IBAMA's website[72].

Besides, in accordance with resolution # 7, issued on March 5^{th} 2008[77], the CIMGC requests, among other documents, comments from local stakeholders in order to provide the Letter of Approval for

[76] Resumo das Atividades dos Programas Socioambientais do Projeto Básico Ambiental da UHE Teles Pires – Medidas Preventivas, Mitigadoras, de Controle e Compensatórias. Dezembro 2011.
[77] Available at: <http://www.mct.gov.br/>.

a CDM project activity. The Resolution determines that the project proponent has to send invite for comments, at least, the following agents involved in and affected by project activity:

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

The same resolution also requires that at the time these letters are sent, a version of the PDD in the local language and a declaration stating how the project contributes to the sustainable development of the country must be made available to these stakeholders at least 15 days previous to the starting of the Global Stakeholder Process (GSP).

The Portuguese version of the PDD was published at the internet website <http://sites.google.com/site/consultadcp/> on December 2011 which is also when the invitation letters were sent to the following agents:

- Federal Attorney for the Public Interest;
- State Attorneys for the Public Interest of Mato Grosso and Pará;
- Environmental Agencies of Mato Grosso and Pará;
- Brazilian Forum of NGOs and Social Movements for Environment and Development;
- City Halls of Paranaíta and Jacareacanga;
- City Councils of Paranaíta and Jacareacanga;
- Environmental Agencies of Paranaíta and Jacareacanga;
- Community Associations of Paranaíta and Jacareacanga;

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

E.2. Summary of the comments received:

PDD version prepared for the local and global stakeholders consultation, therefore, no comments have been received yet.

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

PDD version prepared for the local and global stakeholders consultation, therefore, no comments have been received yet.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No official development assistance or related public funding was or will be used in *Teles Pires Hydropower Plant Project Activity*.

Annex 3

BASELINE INFORMATION

This section is intentionally left blank. For details please refer to section B.6.1. and B.6.3. above.

Annex 4

MONITORING INFORMATION

This section is intentionally left blank. For details please refer to section B.7.2. above.