**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	SHPs Coronel Araújo and Passo Ferraz CDM Project (JUN1059), Brazil
Version number of the PDD	3.1
Completion date of the PDD	20/01/2014
Project participant(s)	Coronel Araújo Energética S/A, Passo Ferraz Energia S/A, Carbotrader Assessoria e Consultoria em Energia Eireli (privates entities)
Host Party(ies)	Brazil
Sectoral scope(s) and selected methodology(ies)	Sectoral Scope I - Energy Industries (renewable/non-renewable sources) AMS I.D. methodology, version 17.0
Estimated amount of annual average GHG emission reductions	10,431 tCO_2

SECTION A. Description of project activity
A.1. Purpose and general description of project activity

The project activity consists in the construction of the Coronel Araújo Small Hydropower Plant (SHP) with final installed capacity of 5,797 kW and Passo Ferraz Small Hydropower Plant (SHP) with final installed capacity of 4,001.4 kW (Greenfield projects).

The **Coronel Araújo SHP** is located on the Chapecó River, Uruguay river basin, in the municipality of Água Doce - Santa Catarina State, Brazil. It has a small reservoir with 0.40 km^2. The SHP will be managed by the Coronel Araújo Energética S/A, special purpose company responsible for the power plant construction and operation.

The **Passo Ferraz SHP** is located on the Chapecozinho River, Uruguay river basin, in the municipality of Bom Jesus - Santa Catarina State, Brazil. It has a small reservoir with 0.056 km^2. The SHP will be managed by the Passo Ferraz Energia S/A, special purpose company responsible for the power plant construction and operation.

With respect to the contribution of the project in the greenhouse gases emissions mitigation (GHG) and the global warming, the project activity reduces the emissions of these gases avoiding the entrance in operation of thermoelectric units that burn fossil fuel in its operation. The main source of emissions is the CO2emission from electricity generation in thermo electrical plants that will be displaced due to the project activity, as described in the item B.3. The estimated average annual reductions of GHG emissions is 10,431tCO2 (Total for 7 years = 73,017 tCO2). In the absence of the project activity (baseline scenario, which is also the scenario existing prior to the implementation of the project activity), fossil fuels would be burned in thermoelectric generation units connected to the network. This initiative will help Brazil achieve its goal of promoting sustainable development.

For Project Participants the project activity is a sustainable alternative for electricity generation because the project consist of Small Hydropower Plants with small reservoirs, which have low environmental impact, almost zero if compared to the large hydroelectric power plants.

Moreover, the project activity is in line with the specific requirements[1] of the CDM (Clean Development Mechanism) of the country host, because:

- Contributes with the sustainable development because it will reduce the fossil fuel use (non-renewable source). Thus the project contributes to a better utilization of the natural resources and it does use of clean and efficient technologies;
- It contributes to better working conditions and increases the employment opportunities in areas where the projects are located (rural areas);
- It contributes to the better conditions for the local economy, because the renewable energy use reduces the fossil fuel dependence, the amount of associated pollution and the social costs related with it.

A.2. Location of project activity
A.2.1. Host Party(ies)
Brazil

[1] The specific requirements of the CDM are in the document "Manual para Submissão de Atividades de Projeto no Âmbito do MDL – from CIMGC Brazil (DNA)", Page 16.

A.2.2. Region/State/Province etc.
South Region –Santa Catarina State (SC)

A.2.3. City/Town/Community etc.

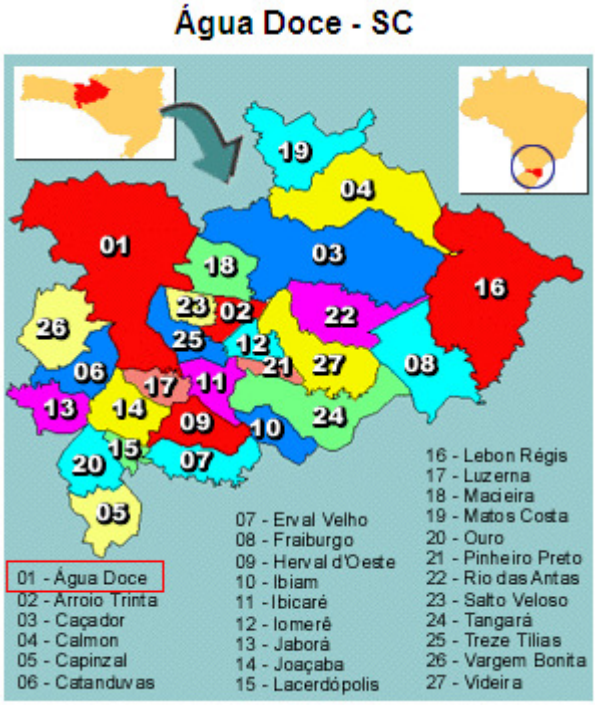
SHP Coronel Araújo – City of Água Doce
SHP Passo Ferraz – City of Bom Jesus

A.2.4. Physical/ Geographical location

The Coronel Araújo SHP is located on the Chapecó river, the geographical coordinates of the dam location are 26° 40' 21" S and 51° 45' 09" W or -26.6725 latitude and -51.7525 longitude, in the city of Água Doce, State of Santa Catarina, south region, Brazil.

The Passo Ferraz SHP is located on the Chapecózinho river, the geographical coordinates of the dam location are 26º 45' 32.10" S and 52º 23' 07.59" W or -26.7589 latitude and -52.3854 longitude, in the city of Bom Jesus, State of Santa Catarina, south region, Brazil.

Figure 1: Água Doce and Bom Jesus Cities – Physical Location



Bom Jesus - SC

Source: City Brazil – www.citybrazil.com.br.

A.3. Technologies and/or measures

The project activity consists in the use of water coming directly from the river to generate electricity. The water potential gravitational energy is used to move the turbines. The turbines trigger the generators that produce electrical energy. This is a clean and renewable energy source that presents minimal impact on the environment.

The Coronel Araújo and Passo Ferraz Small Hydropower Plants (SHPs) are enterprises classified as Small Hydropower Plants because according to Resolution 652, 12/09/2003, of National Electricity Energy Agency (ANEEL), to be considered small hydroelectric central, the reservoir area must be less than 3 km^2 (300 ha) and generation capacity must be between 1 MW and 30 MW. These enterprises are also called "run of river" plants, which does not include significant water "stocks".

The SHPs will be interconnected with National Interconnected System (from portuguese *Sistema Interligado Nacional* - SIN). The technology and equipment utilized in project activity are developed and manufactured in Brazil and the know-how or technology transference to host country is not established.

Due to specific design requirements for small-scale project activities, the project type for the proposed small-scale CDM project activity is: Type I: Renewable energy project activities with a maximum output capacity of 15 MW (the sum of the output capacity of the proposed CDM project activities does not exceed the maximum output capacity limit for its type).

The SHPs main characteristics are specified below:

Table 1: Coronel Araújo SHP technical characteristics

Generator	Characteristics

Type	Synchronous
Quantity	2
Power (kW)	2 x 2,898.5
Nominal Power (kVA)	2 x 3,100
Voltage (kV)	2 x 6.9
Frequency (Hz)	60
Cos φ	0.935
Assured Energy [2](MWaverage)	3.89[3]
Turbines	**Characteristics**
Type	Francis
Quantity	2
Power (kW)	2 x 3,008
Nominal Flow rate (m^3/s)	2 x 11.09
Rotation (rpm)	514.28
Head (m)	30.4

Table 2: Passo Ferraz SHP technical characteristics

Generator	**Characteristics**
Type	Synchronous
Quantity	3
Power (kW)	3 x 1,333.8
Nominal Power (kVA)	3 x 1,482
Voltage (V)	3 x 2,100
Frequency (Hz)	60
Cos φ	0.90
Assured Energy (MWaverage)	2.10[4]
Turbines	**Characteristics**
Type	Kaplan
Quantity	3
Power (kW)	3 x 1,382
Nominal Flow rate (m^3/s)	3 x 19.52

[2] ANEEL allows generators to sell all of their "assured energy" via freely negotiated contracts with consumers above 3MW (this value is equivalent to the Plant Load Factor)
[3] ORDINANCE, NUMBER 58 (Mines and Energy Ministry) from 30/07/2012
[4] ORDINANCE NUMEBR 24 (Mines and Energy Ministry) from 27/04/2012

Rotation (rpm)	360
Head (m)	8.0

Regarding grid connection, SHP Coronel Araújo shall deliver electricity through transmission line from the SHP´s Substation until Palmas Substation, that belongs to COPEL Company – the local energy concessionaire, being this the grid connection point (distance: 35 km)[5]. And the SHP Passo Ferraz shall deliver electricity from the SHP´s Substation until Xanxerê Substation, that belongs to CELESC Company - local energy concessionaire, (distance: 16.2 km) the grid connection point is located inside the SHP Powerhouse.

The meters equipments actually (can be changed during the project lifetime) are:

SHP Coronel Araújo: 2 Bidirectional (main and backup), Landis Gyr, SAGA, Class 0.2 both located in a panel inside Palmas substation.
SHP Passo Ferraz: 2 Bidirectional (main and backup), Landis Gyr , SAGA, Class 0.2 both located in a panel inside SHP Powerhouse. More details in the Section B.7.1 and B.7.3.

All the SHP´s equipments are new and have lifetime at least 30 years based on industry standards and manufacturer's specifications.

In operation under the existing scenario, prior to the implementation of the project activity that is the same that the baseline scenario, there were not any operating in the place where the SHPs will be installed, then there were not any facility, systems or equipments working.

A.4. Parties and project participants

Party involved (host) indicates a host Party	**Private and/or public entity(ies) project participants (as applicable)**	**Indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Brazil (Host)	Coronel Araújo Energética S/A (private entity)	No
	Passo Ferraz Energia S/A (private entity)	
	Carbotrader Assessoria e Consultoria em Energia Eireli (private entity)	

A.5. Public funding of project activity

There is no public funding provided by international organizations for project works performance so carbon credits revenue is the option chosen.

A.6. Debundling for project activity

[5] Since the SHP transmission line belongs to COPEL company the meters are located inside their substation (transmission losses are assumed by the Project Owner).

Based on information provided in Appendix C of the simplified modalities and procedures for small scale CDM project activities, this project activity is not a debundled component of a larger project or program. This is a unique CDM project proposed by the project developer at this moment. The project participants have not registered or operated (are not therefore engaged in any way) in any other small-scale CDM project activities in hydropower, or using any other technologies within the project boundary, and surrounding the project boundary.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

AMS-I.D. - Grid connected renewable electricity generation -Version 17.0 (EB 61, valid from 17 June 2011 onwards). http://cdm.unfccc.int/UserManagement/FileStorage/V9LRSXKP24Q7YT6HZDUBO3C0ING8AJ

And the:

"Tool to calculate the emission factor for an electricity system" – version 03.0.0 (EB 70, from 23 November 2012). http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v3.0.0.pdf

"Methodolgy ACM0002": Consolidated baseline methodology for grid-connected electricity generation from renewable sources - Version 13.0.0 http://cdm.unfccc.int/UserManagement/FileStorage/DYPFI935XBG274NWH6O8CM1KEZR0VU

B.2. Project activity eligibility

In accordance to sector scopes list available on UNFCCC website, the category in which the project is classified belongs to Sector Scope I - Energy Industries (renewable/non-renewable sources).

The project activity is applicable to type I of small-scale projects (renewable energy), methodology I.D. – Grid connected renewable electricity generation – since it is classified within applicability requirements necessary for this category.

This category encompasses renewable sources, as **hydro**, which supplies electricity to a national or a regional grid, with installed capacity **lower than 15 MW** and **reservoirs** that satisfies at least one of the following conditions:

- The project activity is implemented in an existing reservoir with no change in the volume of reservoir;
- 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;
- **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.**

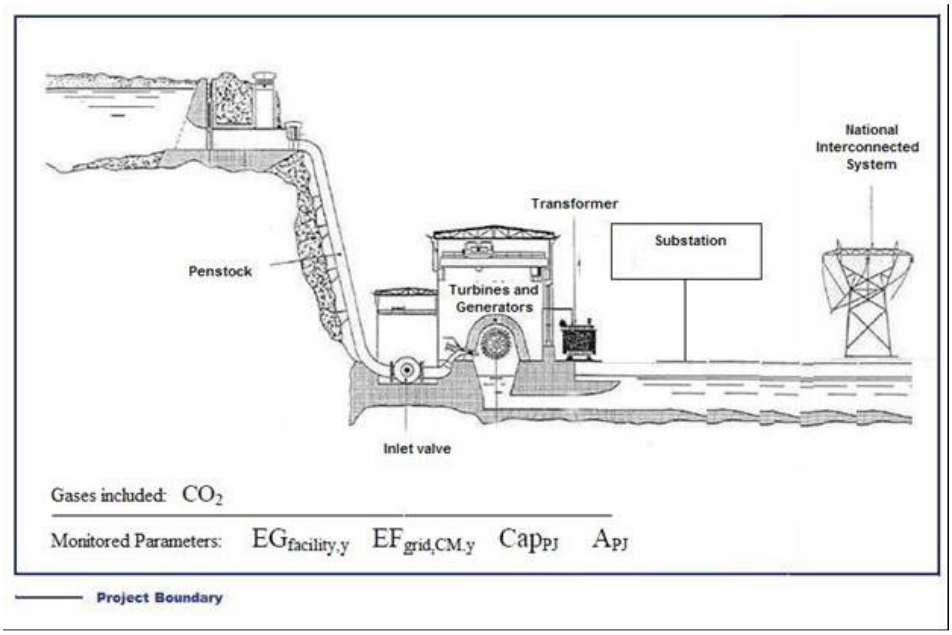
The project activity will supply electricity to Brazilian National Interconnected System. The two SHPs (Coronel Araújo and Passo Ferraz) installed capacity is 9,798.4 kW. The maximum limit established for Small Scale CDM Projects is 15,000 kW (15 MW). So, the project activity capacity is below the limit established by the methodology. It will be Greenfield power plants and will result in new reservoirs with Power Density (PD) of 14.49 W/m^2 for SHP Coronel Araújo and 71.45 W/m^2 for SHP Passo Ferraz, so greater than 4 W/m^2 eligible for this methodology.

B.3. Project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that is 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 scenario	For hydro power plants, emissions of CH_4 from the reservoir.	CO_2	No	Minor emission source.
		CH_4	No	Considering that the Power Density of the Small Hydropower Plants are greater than 10 W/m^2, emissions from the reservoir are considered null.
		N_2O	No	Minor emission source.

According to methodology AMS-I.D the project boundary encompasses the physical and geographical locality of the renewable generation source.

In this way the project boundary is the area where project is located, which contains the reservoir area, dam, the powerhouse which includes main equipments as turbines and generators, SHPs substations, measurement system and the National Interconnected Grid. The diagram below shows the project boundary (per SHP):



Regarding grid connection location, SHP Coronel Araújo shall deliver electricity to COPEL (local energy concessionaire) substation being this the connection point. And SHP Passo Ferraz shall deliver electricity to CELESC (local energy concessionaire) substation being this the grid connection point.

B.4. Establishment and description of baseline scenario

The project activity is the installation of a new grid-connected renewable power plant/unit. The baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the grid-connected power plants operation or by the new generation sources addition .

The baseline emissions are the product of electrical energy generation baseline $EG_{BL,y}$ expressed in MWh coming from the renewable electricity generation units production multiplied by the grid emission factor (in tCO_2e/MWh) calculated in a transparent and conservative manner

The region where is located Água Doce and Bom Jesus cities (Santa Catarina State) and its neighbouring municipalities is supplied by the National Interconnected Electric Grid. Part of the electricity produced by the project activity would have to be generated, in case of its absence, by thermal plants connected to electrical grid and fed with fossil fuels, increasing anthropogenic emissions. The addition of 52,472 MWh/year by the SHPs Coronel Araújo and Passo Ferraz shall comply with all small scale project activity requirements under Clean Development Mechanism.

In this context, the project activity uses as Emission Factor calculation source the National Interconnected System (SIN) data for the operating and building margin, these datas are public available and provided by the Designated National Authority (DNA) of the host country.

The CO_2 Emission Factor resulting of the electrical energy generation verified in the National Interconnected System (SIN) is calculated based on generation registers of plants centrally operated by the **National Grid Operator (ONS)**, which includes thermoelectric power plants that use fossil fuel as energy source.

The methodology used for this calculation is the dispatch data analysis, which is the most appropriate in determining the emission factor of electrical grid.

This information is needed for renewable energy projects connected to electric grid and implemented in Brazil as a **Clean Development Mechanism (CDM)** of Kyoto Protocol.

The emission factor datas results from the National Electric System Operator (ONS), Mines and Energy Ministry (MME) and the Science and Technology Ministry workforce , which become public available for CDM project proponents. Thus, they can be applied in *ex-ante* calculation of avoided emissions by the project activity calculation, and emission reduction shall be calculated *ex-post*.

Further details of the project baseline development can be viewed through the link: http://www.mct.gov.br/index.php/content/view/73318.html.

B.5. Demonstration of additionality

According to *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0 of 20 July 2012), a barrier analysis must be done in order to demonstrate the project additionality, as described below:
The Project Participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) **Investment barrier**: This barrier evaluates a financially more viable alternative to the project activity would have led to higher emissions;

(b) **Technological barrier:** This barrier evaluates a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) **Barrier due to prevailing practice:** This barrier evaluates prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) **Other barriers:** This barrier evaluates without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The project activity Barrier is described below:

(a) Investment barrier

The Benchmark analysis was used in order to demonstrate Investment barrier (considered appropriate to this kind of project activity decision context)[6].
The financial indicator selected for the CDM project activity is the Internal Rate of Return (**IRR**). The financial/economic analysis is based on parameters that are market standards.
The benchmark analysis is performed comparing project IRR (obtained from CAPM – Capital Asset Pricing Model) with the benchmark. The established benchmark for this comparison is the **Weighted Average Cost of Capital(WACC´r),** in line with accounting rules generally accepted. The details are described below:

Calculation and comparison of financial indicators

$r = w_d K_d(1-T) + w_e K_e$

Where:

r	=	WACC
w_d	=	Percentage of debt financing
w_e	=	Percentage of equity financing
K_d	=	Average cost of debt financing
K_e	=	Average cost of equity financing
T	=	Applicable corporate tax rate

Considering that the SHPs were financed solely with sponsor capital, the non-leveraged model is used to calculate the WACC.

K_e – Cost of Equity

The **cost of equity** was calculated as the sum of a tax free of risk (US Bonds) plus a Brazilian risk premium plus a global risk premium to the equity investment. This calculation methodology follows the recommendations for equity calculation presented in "**Guidelines on the assessment of investment analysis**" published in 62 meeting of the CDM Executive Board (Annex 5).

Cost of Equity calculation

The cost of equity was calculated as follows:

$$\mathbf{K_e = GB + PE_g}$$

[6] Other options could be the simple cost or investment comparison analysis, but since the project activity has other revenues than CDM benefits the simple cost must be discarded and there aren´t other investment alternatives for project sponsors. So the benchmark analysis was adopted in order to check additionality.

Where:

K_e = Cost of equity;
GB = Tax Free of Risk (Rf) + Host country risk premium (ERP)
PE_g = Global Equity risk premium

Rf = Average of return rates of American Bond (T-Bond) corresponding to years 1996 to 2005[7], value applied 6.31%;
ERP (EMBI+ $_{1996\ -\ 2005}$) = Average of Brazilian Risk Premium, based on data from JP Morgan corresponding to years 1996 to 2005[8], value applied 7.09%;

So, GB = 6.31% + 7.09% = 13.4%

PE_g = Global Equity Risk Premium provided by Aswath Damodaran[9].

Therefore:

K_e = 13.4% + (0.804*7.89)%[10] = 19.74%

Considering the exclusion of the inflation rate 4.76%, the Project Activity **Cost of Equity is 14.98%**[11].

The K_d considered is the commercial bank lending rate (in this case the rate from BNDES Bank dedicated to this kind of project activity – energy generation). So according to the information publicly available the K_d considered is equal to 13.47%[12]

Due this the WACC = 0% x 13.47 x (1-35%[13]) + 100% x 14.98% = 14.98%

Below, the table 3 summarizes the reference values to the project activity IRR and the equity value used as benchmark.

Table 3: Comparative table between project activity IRR and the project benchmark

Benchmark (%)	**IRR SHP Coronel Araújo (%)**	**IRR SHP Passo Ferraz (%)**

[7] http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/histret.html , 10 years before the SHP Coronel Araújo investment decision.
[8] http://www.ipeadata.gov.br/Default.aspx (EMBI+ Brazil)
[9] Aswath Damodaran - Document "Estimating Discount Rates - 2005" page 14 (for Brazil host country only)
[10] Risk Premium weighted by the Beta = 0.804 (source: http://pages.stern.nyu.edu/~adamodar/pc/archives/emergcompfirm05.xls average of brazilian companies filtered as Country: Brazil / Industry Name: Eletric-generation)

[11] Please, check the worksheet "*Ke_Calculation_v2*" provided for more details about the calculation (in Real Terms and Post Tax)
[12] http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/proesco.html
[13] Brazilian Law 10.637/2002 and 9.718/1998 (IR = 15%+10% and CSLL = 9%), total Tax = 34% (or 24% when applicable, this is not the case)

14.98	12.53	12.74

The cash-flow was elaborated for the project activity period (30 years), getting an Internal Return Rate (IRR) for SHP Coronel Araújo equal 12.53%, without revenues of Certified Emissions Reductions (CERs).
For SHP Passo Ferraz the IRR is 12.74%, without revenues of CERs.

The project activity cash flow will be integrally presented to validation entities in separated worksheets. In the worksheets are also identified all reference sources for the applied values.

The cash flows have as main input values the following:

Table 4: Main Inputs Values of the cash flows

Parameter	SHP Coronel Araújo	References
Investment (R$)	20,750,500.00	Minute from the Board / Project Budget "Eletrobras Standard Budget"
Assured Energy (MWaverage)	3.70[14]	Doc. "Instrumento de cessão de direitos (10/03/2006)" / Minute from the Board
Energy Price (R$/kWh)	130.00	Minute from the Board / CCEE
Operation and Maintenance (R$)	1,075,789.36	Minute from the Board / Document "SHP CAR O&M_Spreadsheet"

Parameter	SHP Passo Ferraz	References
Investment (R$)	13,148,300.00	Project Budget "OPE (18/12/2006)" / Minute from the Board (09/11/2007)
Assured Energy (MWaverage)	2.21[15]	OPE (18/12/2006) / Minute from the Board (09/11/2007)
Energy Price (R$/kWh)	140.00	Minute from the Board (09/11/2007)
Operation and Maintenance (R$)	669,189.00	O&M_Spreadsheet (out/2007) / Minute from the Board (09/11/2007)

The project's IRRs have stayed below of project proponent`s WACC value. The analysis shows that the project is not economically or financially feasible, without the revenue from certified emission reductions (CERs) sale .
The CERs are highly significant instruments for entrepreneurs in overcoming barriers, improving investment quality and hence stimulating future investments in clean energy generation.

The complete list of cash flow's input values (parameters) are presented below:

SHP Coronel Araújo:

INPUT VALUE	VALUE	UNIT

[14] 3.70 MWaverage instead 3.89 MWaverage since this is the value available at the time of investment decision
[15] 2.21 MWaverage instead 2.10 MWaverage since this is the value available at the time of investment decision

Investment	**20.750.500**	R$ - Real
Assured Energy	**3,70**	MW average
Installed power	**5,80**	MW
Generation per year	**32.412**	MWh/year
Energy Price	**130,00**	R$/MWh
Operation	**30**	years
PIS - Social Contribution Program	**0,65%**	on gross revenue
COFINS - Social Security Financing Transfers	**3,00%**	on gross revenue
Base Value for the IR calculation	**8,00%**	on gross revenue
Base Value for the Social Contribution calculation	**12,00%**	on gross revenue
IR - Income Taxes	**15%**	on base value
CSLL - Social Contribution on Net Profit	**9%**	on base value
Aditional IR	**10%**	on base value
Operation and Maintenance	**1.075.789,36**	R$/year
ANEEL - Fiscalization fee	**9.609**	R$/year
Distribution Use of System Charge - TUSD	**79.692**	R$/year
Residual	**40%**	on total asset

SHP Passo Ferraz:

INPUT VALUE	VALUE	UNIT
Investment	**13.148.300,00**	R$ - Real
Assured Energy	**2,21**	MW average
Installed power	**4,0**	MW
Generation per year	**19.397**	MWh/year
Energy Price	**140,00**	R$/MWh
Operation	**30**	years
PIS - Social Contribution Program	**0,65%**	on gross revenue
COFINS - Social Security Financing Transfers	**3,00%**	on gross revenue
Base Value for the IR calculation	**8,00%**	on gross revenue
Base Value for the Social Contribution calculation	**12,00%**	on gross revenue
IR - Income Taxes	**15%**	on base value
CSLL - Social Contribution on Net Profit	**9%**	on base value
Aditional IR	**10%**	on base value
Operation and Maintenance	**669.189**	R$/year
ANEEL - Fiscalization fee	**4.596,20**	R$/year
Distribution Use of System Charge - TUSD	**60.960**	R$/year
Residual	**40%**	on total asset

To better understand the investment barrier was also performed a **sensitivity analysis** in which were varied the following parameters: (1) Investment, (2) Energy Price, (3) Assured Energy (Plant Load Factor) and (4) Operation and Maintenance costs, in order to check the financial impact on the project.

A **Breakeven Point Analysis** was performed in order to discuss the occurrence likelihood of these scenarios.

The table 5 presents the main results of the analysis.

Table 5: Project Activity sensitivity analysis

SHP Coronel Araújo

Parameter	Original Value	% of deviation	New IRR	Breakeven point	% of deviation
Investment (R$)	20,750,500.00	-10.00	13.94%	17,357,793.00	-16.35%
Assured Energy (MWaverage)	3.70	+10.00	14.29%	4.22	+13.95%
Energy Price (R$/kWh)	130.00	+10.00	14.29%	148.14	+13,95%
Operation and Maintenance (R$)	1,075,789.36	-10.00	13.02%	527,137	-51.00%

SHP Passo Ferraz

Parameter	Original Value	% of deviation	New IRR	Breakeven point	% of deviation
Investment (R$)	13,148,300.00	-10.00	14.15%	11,162,907.00	-15.10%
Assured Energy (MWaverage)	2.21	+10.00	14.50%	2.50	+12.80
Energy Price (R$/kWh)	140.00	+10.00	14.50%	157.92	+12.80
Operation and Maintenance (R$)	669,189.00	-10.00	13.21%	343,294	-48.70%

In the light of variations above described, it is possible to verify that for all analyzed parameters the breakeven point overcome variation margin of 10% determined by CDM as sensitivity indicator. Therefore, fluctuations of this amplitude would not lead the project activity´s IRR to reach or overcome the considered benchmark.

The project activity has taken in consideration the CERs sale revenues for their implantation. These financial benefits generated in strong currency (euro or dollar) bring to the project better security against monetary depreciations.

Therefore, the project activity is additional.

Table 6: Project Activity timeline (per SHP)

SHP Coronel Araújo:

2006			
05/01/2006	**CDM Prior Consideration**	Minute from the Board Meeting	Document: "Ata Reunião Diretoria 05.01.2006 Coronel Araújo"
06/01/2006	Keeping CDM Status	Memorandum with a third party, where PP has committed to deliver the CERs related to the Coronel Araújo.	Pre Contract: "PCH CAR_Memo_06012006".
19/05/2006	**Project Activity Starting Date**	Civil contract signed. Date on which the project participant has committed to major expenditures for construction services. - Start date	Contract signed with COMAX company
22/05/2006	Keeping CDM Status	Bid requisition for the PDD development (Consultants for CDM/PDD).	E-mail: "Proposta Comercial"
20/06/2006	Project Activity Implementation	Generators Aquisition	Contract signed with WEG company
20/08/2006	Project Activity Implementation	Turbines Aquisition	Contract signed with Hacker company
2007			
02/03/2007	Keeping CDM Status	Reviewed proposal for PDD development (CDM Consultant)	E-mail: "Proposta Revisada - Carbotrader".
19/09/2007	Keeping CDM Status	PDD development contracted (First Validation Attempt).	E-mail: "Minuta de Contrato"
10/10/2007	Project Activity Implementation	ANEEL had authorized Coronel Araújo SHP generation in test.	ANEEL Dispatch: "PCH CAR_dsp_liberacao oper teste"
2008			
22/01/2008	Keeping CDM Status	DOE contraction process started (First Attempt).	DOE proposal: "Proposta BVC_2201008".
2009			
06/03/2009	Keeping CDM Status	PDD Publication for stakeholders comments in the UNFCCC website (First Attempt).	http://cdm.unfccc.int/Projects/Validation/DB/RHTLYN2B32G63YV4SMQAJA2QFGVRRG/view.html
25/11/2009	Keeping CDM Status	DOE Contract Termination (about he prior Bundle Validation - First Attempt).	Document: "Termination of Contract"
2010			
21/06/2010	Keeping CDM Status	A new Bundle CDM Project was designed (The Bundle should include the SHPs Coronel Araújo and Passo Ferraz in the same PDD)	Minute from the Board on 21/06/2010
2011			
09/06/2011	Keeping CDM Status	Local Stakeholders Consultation (Second Validation Attempt)	Letters´ receipt confirmations.
27/09/2011	Keeping CDM Status	New DOE contract process is started	E-mail "RES Orçamento de Validação MDL - PCHs CAR e PFZ"
2012			
04/12/2012	Publication for stakeholders comments	PDD Publication for stakeholders comments in the UNFCCC website (Second Attempt).	http://cdm.unfccc.int/Projects/Validation/DB/9NPLGW23M6ER9RZS9T4FLTA7YIC4LR/view.html

SHP Passo Ferraz:

2006			
20/12/2006	**CDM Prior Consideration**	PDD consult for development services	E-mail "Fw Proposta Comercial"
2007			
19/06/2007	Keeping CDM Status	DOE consult for the Validation Process	E-mail "Proposta Validação Val1184"
09/11/2007	Keeping CDM Status	Board Meeting considering the CDM benefits/revenues	Minute from the Board on 09/11/07
08/12/2007	**Project Activity Starting Date**	Generators Aquisition - Start Date	Fiscal Documents Number 196/197/198
2008			
08/08/2008	Project Activity Implementation	ANEEL aproves the SHP Project Design	Dispatch Number 2966
16/10/2008	Keeping CDM Status	The Board discuss about CERs selling	Minute from the Board on 16/10/2008
2009			
27/02/2009	Project Activity Implementation	Turbines Aquisition	Contract with Haker and Kroner Ltda company
06/04/2009	Project Activity Implementation	Civil Works Aquisition	Contract with COMAX company
13/10/2009	Project Activity Implementation	ANEEL SHP authorization	Autorizative Resolution Number 2132
23/11/2009	Keeping CDM Status	Board Meeting changing the PP name (due to the societary changes) and considering the carbon credits target on the purpose	Document "AtaTransf.S.A"
2010			
21/06/2010	Keeping CDM Status	A new Bundle CDM Project was designed (The Bundle should include the SHPs Coronel Araújo and Passo Ferraz in the same PDD)	Minute from the Board on 21/06/2010
2011			
05/05/2011	Project Activity Implementation	ANEEL SHP authorization for the Test Operation	Brazilian Midia publication *(Diário Oficial da União)*
09/06/2011	Keeping CDM Status	Local Stakeholders Consultation	Letters´ receipt confirmations.
27/09/2011	Keeping CDM Status	New DOE contract process is started	E-mail "RES Orçamento de Validação MDL - PCHs CAR e PFZ"
01/10/2011	Project Activity Implementation	SHP Commercial Operation Start	Document "Anexo II - CRONOGRAMA"
2012			
04/12/2012	Publication for stakeholders comments	PDD Publication for stakeholders comments in the UNFCCC website	http://cdm.unfccc.int/Projects/Validation/DB/9NPLGW23M6ER9RZS9T4FLTA7YIC4LR/view.html

As observed all Power Plants took in consideration the CDM benefits before and also during the project activity implementation. The SHP Coronel Araújo started their implementation in 19/05/2006 and become operational in 10/10/2007, before, during and after this, the CDM status was kept by the evidences listed in the respective table above (**CDM Prior Consideration** and **Keeping CDM Status** evidences).

Also SHP Passo Ferraz started their implementation in 08/12/2007 and become operational in 01/10/2011, before, during and after this, the CDM status was kept by the evidences listed in the respective table above (**CDM Prior Consideration** and **Keeping CDM Status** evidences).

B.6. Emission reductions

B.6.1. Explanation of methodological choices

Baseline emissions

The baseline emissions are the product of electrical energy baseline $EG_{BL,\,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} \cdot EF_{CO2,grid,y}$$

Where:

BE_y =Baseline Emissions in year y (t CO2/year)
$EG_{BL,\,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh/year)
$EF_{CO2\ grid,\,y}$ = CO2 emission factor of the grid in year y (t CO2/MWh)

The Emission Factor can be calculated in a transparent and conservative manner using the combined margin (CM), consisting of Operating Margin (OM)[16] and Build Margin (BM) combination according to procedures described in "Tool to calculate the Emission Factor for an electricity system".

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year *y* (tCO2/MWh)
w_{OM} = Weighting of operating margin emissions factor (%)
w_{BM} = Weighting of build margin emissions factor (%)

Thus, from the tool, grid emission factor is $EF_{grid,CM,y}$ which in this case is the same used in the present project activity: $EF_{CO2,grid\ y}$.

Considering that project activity is based on SHPs, the calculation of the combined margin emissions factor shall use the following default values for w_{OM} and w_{BM}:

w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period , and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period.

Project Emissions

Since SHPs Power Density (PD) are higher than 10W/m^2

$PE_y = 0$

PE_y = Project Emission in the year *y*

PD Coronel Araújo = 5.797 MW / 0.40 km^2 = 14.49 W/m^2
PD Passo Ferraz = 4.0014 MW / 0.056 km^2 = 71.45 W/m^2

Leakage

There are no energy generating equipments transfers from or to another activity, so according to methodology the leakage is considered zero.

L_y= 0

Emissions Reductions

The emission reduction is calculated as follows:

[16] The method to determine the Operating Margin is the dispatch data analysis OM (option c in the Tool, since these datas are available to the project proponents) so it 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.

$ER_y = BE_y - PE_y - L_y$

As $\boldsymbol{PE_y = 0}$ and $\boldsymbol{L_y = 0}$, $\boldsymbol{ER_y}$ is:

$\boldsymbol{ER_y = BE_y}$

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$Cap_{BL\_SHP\ Coronel\ Araujo}$
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	Project site.
Value(s) applied	0
Choice of data or Measurement methods and procedures	Not applicable.
Purpose of data	Calculation of the project emissions.
Additional comment	

Data / Parameter	$Cap_{BL\_SHP\ Passo\ Ferraz}$
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	Project site.
Value(s) applied	0
Choice of data or Measurement methods and procedures	Not applicable.
Purpose of data	Calculation of the project emissions.
Additional comment	

Data / Parameter	$A_{BL\_SHP\ Coronel\ Araujo}$
Unit	m^2
Description	Area of the reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.
Source of data	Project site.
Value(s) applied	0
Choice of data or Measurement methods and procedures	Not applicable.
Purpose of data	Calculation of the project emissions.
Additional comment	

Data / Parameter	$A_{BL\_SHP\ Passo\ Ferraz}$
Unit	m^2
Description	Area of the reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.
Source of data	Project site.
Value(s) applied	0
Choice of data or Measurement methods and procedures	Not applicable.
Purpose of data	Calculation of the project emissions.
Additional comment	

Data / Parameter:	EF_{res}
Unit	$kgCO_2e/MWh$
Description	Default emission factor for emission from reservoirs.
Source of data	Decision by EB 23.
Value(s) applied	90
Choice of data or Measurement methods and procedures	Standard value.
Purpose of data	Calculation of project emissions.
Additional comment	Applicable to calculate project emissions if the power density of project activity become greater than 4 W/m^2 and less than or equal to 10 W/m^2. Therefore, it is not applicable to the SHPs Coronel Araújo and Passo Ferraz while its PD is greater than 10 W/m^2.

B.6.3. Ex-ante calculation of emission reductions

The baseline methodology considers the determination of the grid emission factors, which the project activity is connected to, as core data to be determined in the baseline scenario. In Brazil, the grid is interconnected through the National Interconnected System (SIN) in a single system.

"Operating Margin *OM* Emission Factor" calculation ($EF_{grid,OM-DD,y}$)

The Emission Factor (OM) calculated by the Dispatch Data Analysis is summarized as follows:

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

Where:

$EF_{grid,OM-DD,y}$	Dispatch data analysis operating margin CO_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 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.

For effect of Operation Margin (OM) Emission Factor *ex-ante* calculation will be used, as a good estimation to $EF_{grid,OM-DD,y}$ value, arithmetic average of OM Emission Factor published by DNA for one year period (available data for 2011 year).
(http://www.mct.gov.br/index.php/content/view/333605.html#ancora)

Table 7: Emission factor of operating margin for 2011 year

Average Monthly Factor (tCO_2/MWh)												
year	**2011**											
month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EF	0.2621	0.2876	0.2076	0.1977	0.2698	0.3410	0.3076	0.3009	0.2734	0.3498	0.3565	0.3495

This way, we have the OM Emission Factor:

$EF_{grid,OM-DD,y}$ = 0.2920

"Build Margin Emission Factor BM" calculation ($EF_{grid,BM,y}$)

According to the used methodology, the Build Margin (BM) Emission Factor, also needs to be calculated, as follow the formula below:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} . EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh);
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh);
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh);
m	Power units included in the build margin.

As for the OM Emission Factor, for the build margin emission factor $EF_{grid,BM,y}$ will be adopted the 2011 year value published by the DNA (ultimate data available). It can be viewed in the link: http://www.mct.gov.br/index.php/content/view/333695.html#ancora.

So, the Build Margin (*BM*) Emission factor is:

$\boldsymbol{EF_{grid,BM,y} = 0.1056}$

"Baseline Emission Factor" calculation ($EF_{grid,CM,y}$)

Finally the baseline Emission Factor ($EF_{grid,CM,y}$) of the Combined Margin, is calculated through a weighted-average formula, considering both the $EF_{grid,OM-DD,y}$ and the $EF_{grid,BM,y}$ and the weights w_{OM} and w_{BM} (are default 0.5), that gives:

$$EF_{grid,CM,y} = 0.1056 \cdot 0.5 + 0.2920 \cdot 0.5 = 0.1988 \quad (tCO_2/MWh)$$

The emissions reduction (**ER**) of this project activity is:

$$ER = BE_y - (L_y + PE_y)$$

The baseline emissions would be then proportional to the electricity delivered to the grid throughout the project's lifetime. Baseline emissions due to displacement of electricity are calculated by multiplying the baseline emissions factor ($EF_{grid,CM,y}$) times the electricity generation of the project activity.

$$BE_y = EF_{grid,CM,y}. EG_y$$

The SHP Coronel Araújo and Passo Ferraz electricity generation ($EG_{BL,y}$) in the year y is estimated in 52,472 MWh/year.

Therefore, the baseline emissions will be calculated as follows:

$$BE_y = 0.1988 \cdot 52{,}472 = \mathbf{10{,}431}\ tCO_2e/\text{ year}$$

To this project leakages is not considered, thus:

$\boldsymbol{L_y = 0}$

As said previously the project emission is zero:

$\boldsymbol{PEy = 0}$

So, the project activity emission reduction (**ER**) is:

$$ER = 10{,}431 - (0 + 0) = \mathbf{10{,}431\ tCO_2e/year}$$

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2 e)	Project emissions (tCO_2 e)	Leakage (tCO_2 e)	Emission reductions (tCO_2 e)
2014	10,431	0	0	10,431
2015	10,431	0	0	10,431
2016	10,431	0	0	10,431
2017	10,431	0	0	10,431
2018	10,431	0	0	10,431
2019	10,431	0	0	10,431
2020	10,431	0	0	10,431
Total	73,017	0	0	73,017
Total number of crediting years	7 years, can be renewable for more two periods of 7 years each one.			
Annual average over the crediting period	10,431	0	0	10,431

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{Coronel\ Araújo,y}$
Unit	MWh/year
Description	electricity of the SHP Coronel Araújo delivered to the grid in year y
Source of data	Energy Meters (Main and Backup located in the Palmas Substation)[17]
Value(s) applied	34,076
Measurement methods and procedures	The net electricity delivered to the grid will be checked through the energy metering. The datas from energy meters will be cross checked with CCEE data bank (Electric Power Commercialization Chamber in Brazil). In case of readings difference will be considered the lowest for the calculation of project CERs. For further details see section B.7.3, item "Data monitoring".
Monitoring frequency	Continuous monitoring, hourly measurement at least monthly recording and should 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.
QA/QC procedures	The bidirectional meters must comply with national standards and industrial regulations to ensure accuracy (actually class 0.2). The meters will be sealed for safety after the calibration.
Purpose of data	Calculation of baseline emissions.
Additional comment	

[17] Since the SHP transmission line belongs to COPEL (local energy distributor) the meters are located inside their substation (transmission losses is assumed by the Project Owner).

Data / Parameter	$EG_{Passo\ Ferraz,y}$
Unit	MWh/year
Description	electricity of the SHP Passo Ferraz delivered to the grid in year y
Source of data	Energy Meters (Main and Backup located in the SHP Powerhouse)[18]
Value(s) applied	18,396
Measurement methods and procedures	The net electricity delivered to the grid will be checked through the energy metering. The datas from energy meters will be cross checked with CCEE data bank (Electric Power Commercialization Chamber in Brazil). In case of readings difference will be considered the lowest for the calculation of project CERs. For further details see section B.7.3, item "Data monitoring".
Monitoring frequency	Continuous monitoring, hourly measurement at least monthly recording and should 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.
QA/QC procedures	The bidirectional meters must comply with national standards and industrial regulations to ensure accuracy (actually class 0.2). The meters will be sealed for safety after the calibration.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data / Parameter	$EF_{CO2,grid,y}$
Unit	tCO2e/MWh
Description	CO2 emission factor of the grid electricity in year y
Source of data	Data provided by DNA to the year y.
Value(s) applied	0.1988
Measurement methods and procedures	The Emission Factor will be monitored through ex-post calculation, which data are available by the DNA (Designated National Authority). The Combined Margin is calculated through a weighted-average formula, considering both $EF_{grid,OM-DD,y}$ and $EF_{grid,BM,y}$ and the weights w_{OM} and w_{BM} (are default 0.5).
Monitoring frequency	The data will be annually filed (electronic archive) and should be kept for two years after crediting period end or the last CERs issuance for this project activity, whichever occurs later.
QA/QC procedures	
Purpose of data	Calculation of baseline emissions.
Additional comment	

[18] The SHP transmission line belongs to PP, so the meters can be located inside powerhouse in a locked panel (sealed by the CELESC, the local energy distributor company) without PP access.

Data / Parameter	$EF_{grid,OM-DD,y}$
Unit	tCO2/MWh
Description	CO2 Operating Margin emission factor of the grid, in a year y
Source of data	Data provided by DNA to the year y.
Value(s) applied	0.2920
Measurement methods and procedures	The Operating Margin Emission Factor will be collected in the DNA website, which is responsible for this calculation.
Monitoring frequency	These datas will be applied in ex-post Emission Factor calculation. The data will be annually filed (electronic archive) should be kept for two years after crediting period end or the last CERs issuance for this project activity, whichever occurs later.
QA/QC procedures	
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data / Parameter	$EF_{grid,BM,y}$
Unit	tCO2/MWh
Description	CO2 Build Margin emission factor of the grid, in a year y
Source of data	Data provided by DNA (Designated National Authority) to the year y.
Value(s) applied	0.1056
Measurement methods and procedures	The Build Margin Emission Factor will be collected in the DNA website, which is responsible for this calculation.
Monitoring frequency	These datas will be applied in ex-post Emission Factor calculation. The data will be annually filed (electronic archive) should be kept for two years after crediting period end or the last CERs issuance for this project activity, whichever occurs later.
QA/QC procedures	
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data / Parameter	$Cap_{Coronel\ Araújo\ ,y}$
Unit	W
Description	SHP Installed Power after the implementation of the project activity.
Source of data	Project site
Value(s) applied	5,797,000
Measurement methods and procedures	Plaques on the installed equipments.
Monitoring frequency	Continuously
QA/QC procedures	It will be recorded by collecting photographic evidence of the equipments nameplate capacity.
Purpose of data	Calculation of project emissions.
Additional comment	

Data / Parameter	$Cap_{Passo\ Ferraz,y}$
Unit	W
Description	SHP Installed Power after the implementation of the project activity.
Source of data	Project site.
Value(s) applied	4,001,400
Measurement methods and procedures	Plaques on the installed equipments.
Monitoring frequency	Continuously
QA/QC procedures	It will be recorded by collecting photographic evidence of the equipments nameplate capacity.
Purpose of data	Calculation of project emissions.
Additional comment	

Data / Parameter	$A_{Coronel\ Araújo,y}$
Unit	m^2
Description	Area of the reservoir measured in the water surface, after the implementation of the project activity, when the reservoir is full.
Source of data	Reservoir in the Project site.
Value(s) applied	400,000
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Monitoring frequency	Annual or in case of change
QA/QC procedures	Measured from topographical surveys or maps.
Purpose of data	Calculation of project emissions.
Additional comment	

Data / Parameter	$A_{Passo\ Ferraz,y}$
Unit	m^2
Description	Area of the reservoir measured in the water surface, after the implementation of the project activity, when the reservoir is full.
Source of data	Reservoir in the Project site.
Value(s) applied	56,000
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Monitoring frequency	Annual or in case of change
QA/QC procedures	Measured from topographical surveys or maps.
Purpose of data	Calculation of project emissions.
Additional comment	

B.7.2. Sampling plan

The datas and parameters monitored in section B.7.1 above are not determined by a sampling approach. The datas are effectively measured.

B.7.3. Other elements of monitoring plan

The project activity procedures for monitoring electricity generation follow the parameters and regulations of the Brazilian energy sector. The Electric System National Operator (ONS) and the Electric Power Commercialization Chamber (CCEE) are the entities responsible for the energy measurement technical requirements and by the billing. These entities monitoring and approves the energy accurate accounting.

The agent responsible for measurement system for billing (SMF from the Portuguese S*istema de Medição para Faturamento*) should develop the project in accordance with technical specifications of the measurements for billing, which should include the measurement points location, measurement panels, meters and systems for local and remote measurement.

The measurement system shall make the energy measurement and registration, to do that the meters are installed in measurement panels, which are located in control room or measurement cabins. For this system is guaranteed data inviolability, which must be sealed for safety after calibration.

There will have two measurement panels, containing two meters (principal and the back-up).

The measurement system contains also a communication system to send the electricity data dispatched for the grid to the CCEE.

- **Data monitoring:**

The meters readings are used for emission reductions calculations, when Meters are in normal operation state. The monitoring steps are as follows:

(1) The data will be measured hourly and recorded monthly;
(2) Spreadsheets containing electricity delivered to the grid will be generated; the CCEE datas measured will be used to emissions reduction calculation;
(3) The SHPs technical responsibles will provide to Carbotrader the monitored datas from their meters and CCEE datas measured;
(4) The emission reductions will be managed by the project manager at Carbotrader;

- **Quality control:**

(1) Calibration of meters

The meters calibration will be conducted by qualified organization that will have comply with national standards and industrial regulations to ensure system accuracy. The calibration frequency will follow ONS Procedure 12.3[19] . The meters must be sealed for safety after calibration and the calibration records must be archived together with monitoring records.
The class of accuracy in equipment that will be used in the project activity is under national standards (NBR 14519 from Associação Brasileira de Normas Técnicas – Brazilian Association of Technical Standards). It can be viewed in ONS Procedure 12.2[20].

(2) Emergency treatment

In case of measures unavailability from any measurement point, due to maintenance, commissioning or any other reason, will be used the methodology to data estimate as per item 14.3 of CCEE Commercialization Procedure PdC ME.01[21] .

[19] http://www.ons.org.br/procedimentos/modulo_12.aspx
[20] http://www.ons.org.br/procedimentos/modulo_12.aspx
[21] http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=67778d3ef9a3c010VgnVCM1000005e01010aRCRD

- **Data Management:**

All the project activity issues regarding SHPs will be treated by Coronel Araújo Energética S/A and Passo Ferraz Energia S/A Executive Management Sector responsible and by the SHPs Board that controls all issues related to SHPs maintenance and operation. An operational structure for the SHPs will be defined and trained before SHP commercial operation start.
The datas will be annually filed (electronic archive) should be kept for two years after the crediting period end or the last CERs issuance for this project activity, whichever occurs later.

- **Training Procedures:**

All the training necessary for operational team will be provided during plant construction and during plant commercial operation. Also a plant operation manual will be created in order to provide assured instructions. Furthermore, operation, maintenance and calibration procedures will follow the national guidelines set by the National Grid Operator.

- **Emission Factors:**

The Emission Factor related to this project activity ($EF_{CO2,grid,,y}$, $EF_{grid,OM-DD,y}$ and $EF_{grid,BM,y}$) as mentioned previously, are available by Brazilian DNA and it can be viewed at website (www.mct.gov.br/clima). Thus, the data monitoring will be ex-post through periodic access to data provided by DNA.

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity

19/05/2006

This is the date at which the SHP Coronel Araújo (the first venture to start the construction) committed to the expenditures regarding construction services (COMAX Company) required for the project activity. The contract between the companies is the evidence.

C.1.2. Expected operational lifetime of project activity
30 years and 0 months (based on the Manufacture´s statements)

C.2. Crediting period of project activity
C.2.1. Type of crediting period
Renewable crediting period, this is the first period.

C.2.2. Start date of crediting period
01/01/2014 (or in the UNFCCC registration date, which occurs later).

C.2.3. Length of crediting period
7 years and 0 months (renewable twice).

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts

With respect to regulatory permits:
The **Coronel Araújo** Small Hydro Power Plant has authorizations issued by ANEEL:

- Dispatch Number 230, issued on 22/03/2004 approving the Coronel Araújo SHP project design;
- Authorization Resolution Number 231, issued on 05/05/2004 authorizing the SHP implementation.

The **Passo Ferraz** Small Hydro Power Plant has authorizations issued by ANEEL:

- Dispatch Number 2966, issued on 08/08/2008 approving the Passo Ferraz SHP project design;
- Authorization Resolution Number 2132, issued on 13/10/2009 authorizing the SHP implementation.

With respect to environmental permits legislation requires issuing of following licenses:

- **Preliminary License (LP):** preliminary phase of planning activity in which concept and location of enterprise are evaluated. In this phase Environmental Impact Study (EIA) and Environmental Impact Report (RIMA) are analysed, or, depending on the case, the Environmental Control Report (RCA).
- **Installation License (LI):** authorizes implementation of enterprise. In this phase, the Environmental Control Plan (PCA) is analysed, it contains projects for systems of treatment and/or disposing of liquid and atmospheric effluents and solid residue etc.
- **Operation License (LO):** authorizes operation of enterprise after verification of compliance with measures determined in phases of LP and LI.

The project activity has the necessary environmental permits for their development, issued by the FATMA (Environmental State Agency):

The **Coronel Araújo** Small Hydro Power Plant has the following licenses:

- **LAO 552/11** - Environmental Operation License issued on 11/11/2011.
- **LAO 837/07** – Environmental Operation License issued on 29/08/2007.
- **LAI 216/04** – Environmental Installation License issued on 20/12/2005.

The **Passo Ferraz** Small Hydro Power Plant has the following licenses:

- **LAO 953/10** - Environmental Operation License issued on 13/12/2010.
- **LAI 334/10** - Environmental Installation License issued on 30/08/2010.
- **LAP 126/07** – Environmental Previous License issued on 13/06/2007.

There are no impacts considered significant by the project participants. But several environmental improvement actions were made.

The **Coronel Araujo and Passo Ferraz SHPs** uses the hydro potential and this is considered a source of clean and renewable energy, which presents minimal impact to the environment.

The projects have the necessary environmental permits issued by the Environment Foundation (FATMA) - Santa Catarina (SC) state environmental agency.

The Basic Environmental Plans (PBAs) of Coronel Araújo and Passo Ferraz SHPs have been developed based on Simplified Environmental Reports and on other Environmental Licenses limitations. The activities developed within the environmental programs are presented below:

- Environmental management program;

- Aquatic ecosystem monitoring programs - Including limnologic and water quality monitoring projects, aquatic macrophytes and fish fauna monitoring and control; hydrosedimentologic conditions observation and accumulation basin cleaning;
- Program to control changes in terrestrial ecosystem - Including flora management and conservation projects;
- Development Plan for reservoir surroundings;
- Program for degraded areas recovery;
- Workes orientation program;
- Environmental education programs;

The document cited above explains in detail all the issues taken to meet the environmental rules in Brazil.

SECTION E. Local stakeholder consultation
E.1. Solicitation of comments from local stakeholders

In accordance to Resolution nº.1, dated 11 September 2003 and Resolution nº7, of the Inter-Ministry Commission on Global Climate Change (CIMGC), any CDM projects shall send a letter describing the project and request commentaries by local interested parties.

The project activity applies to only one state of the federation, thus, the invitations of comments should be addressed to the following actors involved and affected by the project activities:

- City Hall and City Councils;
- State environmental body and Municipal environmental body;
- Brazilian Forum of NGOs and Environmental and Development Social Movements - http://www.fboms.org.br;
- Community associations;
- State Prosecutors Office;
- National Prosecutors Office.

In order to satisfy and comply with these resolutions the project proponents sent invitation letters describing the project, and requested commentaries by the following interested parties:

- City Hall of Água Doce;
- City Council of Água Doce;
- City Hall of Bom Jesus;
- City Council of Bom Jesus;
- Shop owners Council of Água Doce;
- Rural Workers Union of Água Doce;
- State Environment Foundation –FATMA (*Fundação Estadual do Meio Ambiente*);
- Brazilian Forum of NGOs and Environmental and Development Social Movements – FBOMS;
- State Prosecutors Office of Santa Catarina;
- National Prosecutors Office.

The interested parties above were invited to present their concerns and provide comments about the project activity. Between 13 until 20/06/2011 the local stakeholders received the Letters from the PP explained in a Summary the project characteristics and also the intention to become a CDM Project activity. The link to the PDD and also sustainable programs from the projects that contributes to the Brazilian sustainable development (in Portuguese) was also delivered to them.
The period for comments is opened until the project activity registration on the CDM. The main channel for contact with the PP (telephone, e-mail, and website) was included in the Letter becoming available to the stakeholders.

Additionally since the SHPs construction start was created the "Social Communication Program" whose main objective was to create a continuous channel of communication between the entrepreneur and society, especially the people directly affected by the project, promoting:
• Disclosure of the importance of the project to local and regional development, building a positive image of the enterprise with the surrounding communities;
• Promotion social integration between the entrepreneur and the local society;
• Creating direct channels of communication between the community and the entrepreneur, and also with public agencies, schools and institutions whose performance is linked to the enterprise;
• Clarification to the population, through their participation in all stages of implementation of the project, the environmental and social impacts caused and their mitigation measures adopted.
• Communication to all employees directly or indirectly involved with the implementation of the project as well as the environmental policy of the entrepreneur and the activities associated with environmental issues adopted and which should be followed during the execution of the project.

During the LoA requisition three additional meetings were done in order to satisfy the DNA requirement based on Resolution 10 of CIMGC.

Were invited the following entities:

- City Hall of Água Doce;
- City Council of Água Doce;
- Environmental Secretary of Água Doce;
- City Hall of Bom Jesus;
- City Council of Bom Jesus;
- State Environment Foundation –FATMA (*Fundação Estadual do Meio Ambiente*);
- Brazilian Forum of NGOs and Environmental and Development Social Movements – FBOMS;
- State Prosecutors Office of Santa Catarina;
- National Prosecutors Office.
- Rural Workers Union of Água Doce;
- Committee for Water Resource Management in Chapecó and Irani Basin;
- And these entities were free to bring any other interested in participate.

The first meeting was done on 06.08.2013 between the following stakeholders (the person on the position or delegate) and the PP:

- Environmental Department of Água Doce;
- Trade, industry and urbanism Department of Água Doce;
- Rural Infrastructure Department of Água Doce, and
- Tourism Department of Água Doce.

The second meeting was done on 07.08.2013 between the following stakeholders (the person on the position or delegate) and the PP:

- City Hall of Bom Jesus (Mayor and Vice);
- Shopkeepers' Chamber of Bom Jesus;

And finally the third meeting was done on 30.08.2013 where was invited all the other stakeholders listed above. Participation of (the person on the position or delegate) and the PP:

- Committee for Water Resource Management in Chapecó and Irani Basin (only this entity participated with three participants).

Was presented to them the proposed project activity, positive and negative impacts and their questions, opinions and suggestions was took in consideration by the project proponents(was done also minutes). The minutes content can be summarized with the following content:

- Proposed project activity presentation and their intention to obtain CDM registration and also the GGH proposed reduction due to the SHPs operation;
- Explained the positive impacts as: employment opportunity, socio and environmental enhancement due the studies done on local area that host the SHPs, listed the environmental programs already described in the section D.1;
- Negative impacts as: the deforestation on the area of SHP´s power houses and reservoirs surrounding.

E.2. Summary of comments received

As local meetings outcomes, described in Section E.1, the opinions over the themes presented can be summarized as:

- There are older expectative about the SHPs to become available,
- The evidenced environmental benefits shall to attract new projects;
- The cities will have receipts increase due to projects operation;
- The benefits shall become evident for the local population stimulating research over preservation options;
- The project success shall to create a environmental conscience over the local population.

E.3. Report on consideration of comments received

Since no negative opinion about the projects were provided during the stakeholders consultation, the PP felt very satisfied about the positive commentaries and project acceptance. And shall to keep efforts in order to continue the good relationship with them.

SECTION F. Approval and authorization

Not applicable.

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Appendix 1: Contact information of project participants

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Appendix 2: Affirmation regarding public funding

No public funding is involved in the present project.

Appendix 3: Applicability of selected methodology

No further information.

Appendix 4: Further background information on ex ante calculation of emission reductions

The CO_2 emission factors for power generation in the Brazilian National Interconnected System (SIN) are calculated based on generation records of plants centrally dispatched by the National Operator of the Electric System (ONS) and, in particular, thermoelectric power plants. Such information is required by renewable energy projects connected to the electrical grid and implemented by under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

The baseline emissions are calculated according to the **"Tool to calculate the emission factor for an electricity system".** With this methodology the National Grid Operator (ONS) is tasked with explaining the SIN´s (National Interconnected System) and the operational practices regulated by the ANEEL (Brazilian Electricity Regulatory Agency) to the work group made up by the Ministry of Science and Technology (MCT) and by the Ministry of Mines and Energy (MME). According to this system, the CO2 Emission Factors applicable to the project activity will be calculated by the National Grid Operator (ONS) for a single system since May 27, 2008.

More details about baseline development of this project can be found through this links:
http://www.mct.gov.br/index.php/content/view/73318.html

Appendix 5: Further background information on monitoring plan

No additional information.

Appendix 6: Summary of post registration changes

Not applicable.

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02	EB 20, Annex 14 08 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		