Project design document form
(Version 12.0)

BASIC INFORMATION	
Title of the project activity	Rondinha Small Hydroelectric Power Plant
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	2
Completion date of the PDD	03/11/2022
Project participants	Rondinha Energética S.A
Host Party	Brazil
Applied methodologies and standardized baselines	Large-Scale Consolidated Methodology ACM0002 - Grid-connected electricity generation from renewable sources, version 20.0.
Sectoral scopes	01
Estimated amount of annual average GHG emission reductions	9,127 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The Rondinha Small Hydroelectric Power Plant CDM project was registered by CDM Executive Board on 18 December 2014[1].This PDD is being submitted to request the renewal of the crediting period for its second crediting period.

The project activity is developed by a special purpose entity named **Rondinha Energética S.A.** The project activity consists in a Small Hydroelectric Power Plant (SHPP) which is located in the Chapecó River, part of the Uruguai River Basin, at the municipality of Passos Maia, which is part of the Santa Catarina State in Brazil. The project consists in a run-of-river power plant with 9.5994 MW installed capacity. The power plant consists of two generators with Kaplan horizontal turbines, in where each generator unit has a nominal power of 5,333 kVA.

During the second crediting period, the project activity is projected to deliver an average of 48,005 MWh/year[2] of renewable electricity to the National Interconnected System (*Sistema Interligado Nacional* - SIN). The project started operation in 04/06/2014[3].

Prior to the implementation of the project activity, the area had no other power plants installed and therefore the project is a greenfield unit. Therefore, according to the large-scale consolidated methodology ACM0002, the baseline[4] scenario is that 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 reflected in the Combined Margin (CM) emission factor calculations described in "TOOL07: Tool to calculate the emission factor for an electricity system".

The SHPP is connected to Brazilian Interconnected System which is the project boundary of the CDM Project. Project and leakage emissions are not expected. The spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to.

During the second crediting period, the project activity is expected to reduce 9,127 tCO_{2e} annually and 63,889 tCO_2e during the second crediting period of 7 years.

The project activity will help Brazil to fulfil its goals of promoting sustainable development. The project is in line with the CDM requirements of the host country since:

(a) It avoids other projects that might generate energy through the burning of fossil fuels, reducing the potential emissions of GHG of those projects;
(b) It created jobs for State of Santa Catarina's people during the construction and operations of the plant. The project created approximately 300 direct jobs and 50 indirect. During operations, the project generates a permanent employment for approximately 12 people to perform tasks such as operation and maintenance, including maintenance of green areas, cleaning and security. It is worth noting that the project gives to its workers formal working conditions.
(c) It helps the local economy of the region, since the plant operation requires many service providers in many areas (health, administrative and juridical, technicians, engineers, etc.)

[1] https://cdm.unfccc.int/Projects/DB/DNV-CUK1418833982.52/view

[2] MME Dispatch 95 from 21/03/2014.

[3] ANEEL Dispatch 1,709 from 03/06/2014.

[4] The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

On the other hand, the operation of the project, and hence the controlled supply of energy, provides incentives to the increase in productive activities in several economic sectors. It has an impact on the job generation for primary and secondary sectors in the midterm (it makes the energy intensive economic activities more dynamic, such as agro-industrial processes) and for the business and services sector in the mid-long term.

(d) Even though the project presents very low environmental impacts, entrepreneurs makes considerable investments developing environmental programs to avoid or mitigate possible impacts. Regarding the regulations stated either by CONAMA or ANEEL, the project has adopted several mitigation actions, such as an environmental education/social communication program, monitoring program of water quality, re-vegetation and degraded lands recovery program, environmental control program to prevent erosion processes in accesses and internal ways from Rondinha SHPP and a fauna monitoring and conservation monitoring program.

(e) The equipment employed in this project is supplied by national manufacturers. Its use requires trainings for specialized local personnel to operate the small hydroelectric power plant and to correctly manage the project.

A.2. Location of project activity

Rondinha project is located in Passos Maia City, Santa Catarina State in the south region of Brazil. The exact location of the project is 26° 40’ 57” South and 52º 02’ 44” West (GPS Coordinates). This localization is supported by the LAI Nº 22/2009 (Installation License delivered by FATMA). Figure 01 below shows the exact location of the plant.

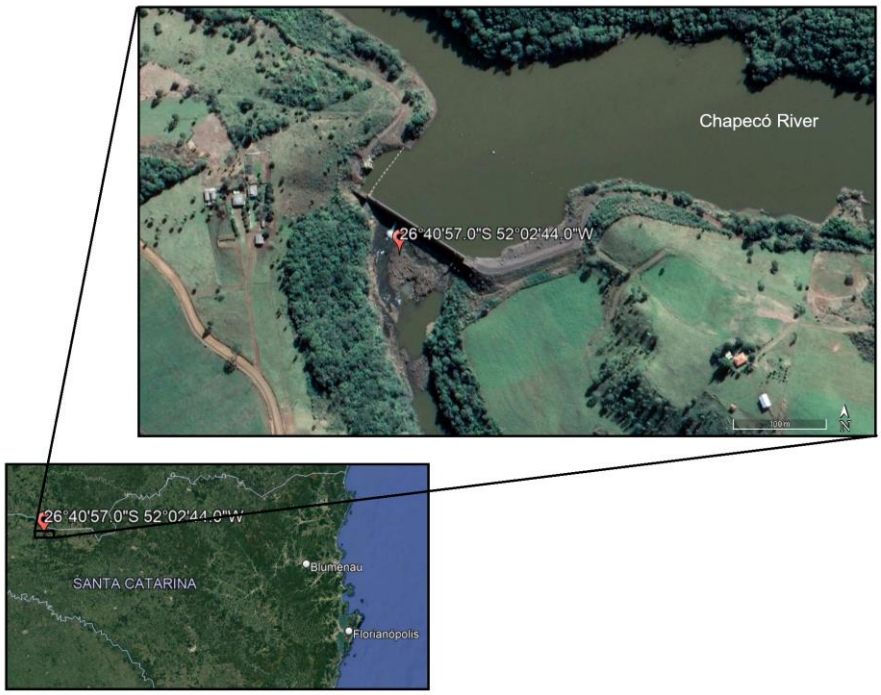

Figure 01 – Location of Rondinha Small Hydroelectric Plant

A.3. Technologies/measures

The project activity generates electricity by a run-of-river power plant, a technology that has the minimum impact on the environment, since the reservoir was designed with a storage capacity of one day of electricity generation.

The project uses Kaplan turbines, which are a widely used technology. This type of turbine is a modification of the Francis turbine, with the intention to produce energy with high-flow and low head conditions.

The project activity generates renewable energy that delivers to the National Interconnected System ("SIN"). In the first crediting period, the plant load factor was defined based on the document presented to the bank (BNDES), which is in line with the Annex 11, EB48 ("Guidelines for the reporting and validation of plant load factors"), as the registered PDD. The expected annual net electricity generation in the first crediting period was 51,500 MWh/year. This value was used for additionality analysis.

In the second crediting period, the expected annual net electricity generation is 48,005 MWh/year[5] as defined by Decree issued by Ministry of Mines and Energy (MME) in 21/03/2014.

The key technical specifications of the hydroelectric plant are the following:

Table 1 – Key technical caracteristics

Parameter	**Rondinha SHPP**
Type of generation	Run-of-river
Power (installed capacity)	9.5994 MW
Reservoir Area	620,000 m²[6]
Turbines (Technical data)	2 Kaplan - Horizontal Axis – 5.410 MW each and 400 rpm.
Generators (Technical data)	2 synchronic generators, 5,333 kVA each – rated voltage 13.8 kV – PF 0.9
Expected net electricity generation (MWh)	48,005 MWh/year

The monitoring equipment follow the Grid procedures indicated by ONS. High accuracy measurement meets stringent ANSI C12.1 Class 0.2 and IEC 62053-22 Class 0.2S, with two decimal points standard.

A.4. Parties and project participants

Parties involved	**Project participants**	**Indicate if the Party involved wishes to be considered as project participant (Yes/No)**
Federative Republic of Brazil (host)	Private Entity: Rondinha Energética S.A	No

A.5. Public funding of project activity

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No public funding for the CDM's project activities was solicited from parties involved in Annex I.

[5] Once this value is lower than projected in the first crediting period, it does not affect additionality analysis.

[6] This a monitored data/parameter. According to the latest Operational License 3370/2018.

A.6. History of project activity

The Rondinha Small Hydroelectric Power Plant CDM project was registered by CDM Executive Board on 18 December 2014[7].This PDD is being submitted to request the renewal of the crediting period for its second crediting period. Rondinha SHPP started its operation in 04/06/2014, as presented at section A.1 of this PDD

The Project Participants confirm that:

1. The proposed CDM project activity is not included as a Component Project Activity (CPA) in a registered CDM Programme of Activities (PoA);
2. The proposed CDM project activity is not a project activity that has been deregistered;
3. The proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA;
4. The proposed CDM project activity is not a registered CDM project activity or a CPA under a registered CDM PoA whose crediting period has or has not expired (hereinafter referred to as former project) exists in the same geographical location as the proposed CDM project activity.

A.7. Debundling

Not applicable. The project is a large-scale project activity.

SECTION B. Application of methodologies and standardized baselines

B.1. References to methodologies and standardized baselines

The CDM Project Standard for Project Activities, version 03.0, item "a" says that the "*project participants shall use the valid version of the methodologies and methodological tools applied in the registered PDD, that is, the latest version at the time of the submission of the request for renewal of crediting period or the previous version if the submission of the request for renewal of the crediting period is still within the grace period of the previous version for use*".

The following methodology was applied:

- ACM0002 Large Scale Consolidated Methodology - Grid-connected electricity generation from renewable sources (Version 20.0) (hereafter referred as ACM0002 Methodology)[8].

This methodology also refers to the latest approved versions of the following tools:

- "TOOL01: Tool for the Demonstration and Assessment of Additionality (Version 7.0.0)"[9];
- "TOOL02: Combined tool to identify the baseline scenario and demonstrate additionality" (Version 7.0)[10];
- "TOOL03: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion"

[7] https://cdm.unfccc.int/Projects/DB/DNV-CUK1418833982.52/view

[8] https://cdm.unfccc.int/filestorage/A/G/0/AG07ZJQ3EXD42LT5YV9HR16M8KINPO/EB105_repan03_ACM0002.pdf?t=eEd8cmh5MnJifDArFYRoezQaHeUXxiFT2uVs

[9] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[10] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf

(Version 3)[11];

- "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 3.0)[12];
- "TOOL07: Tool to calculate the emission factor for an electricity system" (Version 7.0)[13];
- "TOOL10: Tool to determine the remaining lifetime of equipment" (Version 1)[14];
- "TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"[15] (version 03.0.1);
- "TOOL32: Positive lists of technologies[16] (Version 04.0)

According to the CDM Project Standard for Project Activities (version 03.0) "*for renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality*".

As this PDD refers to the second crediting period of the project, the "Tool for the demonstration and assessment of additionality" (TOOL01) and the "Combined tool to identify the baseline scenario and demonstrate additionality" (TOOL02) will not be applied.

The "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (TOOL03) referred by ACM0002 methodology is not applied to the project, since there are no GHG emissions from fossil fuel combustion in the project boundary. "TOOL10: Tool to determine the remaining lifetime of equipment" is either not applied because the project does not involve the replacement of existing equipment with new equipment, or which retrofit existing equipment as part of energy efficiency improvement activities. TOOL32 are not applied once the project activity is not under the positive list of technologies.

B.2. Applicability of methodologies and standardized baselines

The ACM0002 Large Scale Consolidated Methodology, version 20.0, is applicable to grid-connected renewable energy power generation project activities that:

a) Install a Greenfield power plant;

b) Involve a capacity addition to (an) existing plant(s);

c) Involve a retrofit of (an) existing operating plants/units;

d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or

e) Involve a replacement of (an) existing plant(s)/unit(s).

This project activity installed small hydro power plant. Therefore condition "a" is applicable.

The methodology also establishes that the methodology is applicable under the following conditions:

[11] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

[12] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

[13] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[14] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

[15] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

[16] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-32-v4.0.pdf

(a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;

(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects) the existing plant/unit 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, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.

The project includes hydro power plant/unit with small reservoir, and it does not involve capacity additions, retrofits, rehabilitations, or replacements. Therefore condition "a" is applicable and condition "b" is not applied.

The methodology comprises still the following conditions:

In case of hydro power plants, one of the following conditions shall apply:[17]

(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or

(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density, calculated using equation (7), is greater than 4 W/m2; or

(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m2; or

(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m2, all of the following conditions shall apply:

i. The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m^2;

ii. Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;

iii. Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be:

1. Lower than or equal to 15 MW; and

2. Less than 10 per cent of the total installed capacity of integrated hydro power project.

The project activity result in one new single reservoir and the power density of the plant is greater than 4 W/m^2 as provided equation and table 2 presented below. The project activity`s power density, according ACM0002 methodology, is calculated as demonstrated below:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} \qquad \textbf{Equation 1}$$

[17] Project participants wishing to undertake a hydroelectric project activity that results in a new reservoir or an increase in the volume of an existing reservoir, in particular where reservoirs have no significant vegetative biomass in the catchments area, may request a revision to the approved consolidated methodology.

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

The table below evidences that Rondinha SHPP has a power density greater than 4 W/m^2.

Table 2: Power density of each plant

Item	**SHP Rondinha**
Cap_{PJ} (W)	9,599,400
Cap_{BL}	0
A_{PJ} (m^2)	620,000
A_{BL}	0
PD (W/m^2)	15.48

The methodology also predicts that in the case of integrated hydro power projects, project proponent shall:

(a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or

(b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore, this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum of five years prior to the implementation of the CDM project activity.

The project does not comprise integrated hydro power projects. Therefore, these applicability conditions (“a” and “b”) are not applied to the project.

The methodology also establishes that it is not applicable to:

(a) 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;

(b) Biomass fired power plants/units.

The project is formed by small hydro power plant. Therefore, it is neither a biomass plant and it does not involve switching from fossil fuels to renewable energy at the site of the project activity. So, these conditions are not applied.

Another applicability condition of ACM0002 Large Scale Consolidated Methodology, version 20.0 is that in the case of retrofits, rehabilitations, replacements, or capacity additions, the methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business

as usual maintenance". This project activity consists on greenfield small hydro power plant. Therefore, this condition is not applicable.

The project also attends to all applicability conditions of the tools referred in ACM0002 methodology, version 20.0, presented in section B.1, as follows:

- TOOL1: Once the additionally tool is included in ACM0002 Large Scale Consolidated Methodology - Grid-connected electricity generation from renewable sources (Version 20.0), its application by project participants using this methodology is mandatory and it was followed by the registered PDD.
- TOOL 5: This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated:
    - (I) Scenario I: Electricity is supplied to the grid
    - (II) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or;
    - (III) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.

The project activity supplies electricity to the grid. Therefore, scenario I is applied. Therefore, it attends to the applicability conditions of the TOOL5. TOOL5 also predicts some scenarios if emissions are calculated for electricity consumption. However, according to ACM0002 Methodology does not consider emissions for electricity consumption for greenfield power plants.

- TOOL7: This tool is applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). This project activity comprises greenfield power plants that supply electricity to a grid. Under paragraph 4, TOOL7 mentions that it can include off-grid power plants and it establishes the conditions to apply for off-grid power plants. However, this project does not involve off-grid power plants. Therefore, it meets applicability conditions of the tool.

Thus, the ACM0002 methodology, version 20.0, is applicable to the project activity

B.3. Project boundary, sources and greenhouse gases (GHGs)

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The spatial extent of the project boundary includes the project power plant (Rondinha SHPP) and all power plants connected physically to the electricity system that the CDM project power plant is connected to, i.e., SIN.

The Brazilian DNA has defined Brazilian Interconnected Grid (SIN) as the single grid system to be used in every CDM project complying with methodologies ACM0002 and AMS-I.D. This is according to the Resolution Nº8, of May 26th, 2008. Emission sources and gases included in the project boundary are depicted in the table below.

	Source	GHG	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	For dry or flash steam geothermal power plants, emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity
	For binary geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity
	For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers	Low GWP hydrocarbon/ refrigerant	No	Not applicable to this project activity
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable to this project activity
		CH_4	No	Not applicable to this project activity
		N_2O	No	Not applicable to this project activity

A flow diagram of the project boundary, physically delineating the project activity, representing emissions sources and gases included in the project boundary and the monitoring variables, is depicted in Figure 2.

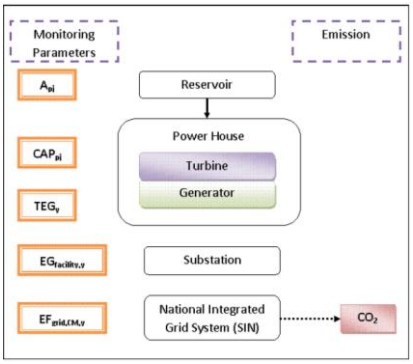

Figure 02 – Flow diagram for the project boundary

B.4. Establishment and description of baseline scenario

According to ACM0002 methodology, version 20.0, if the project activity consists in the installation of a greenfield power plant, the baseline scenario is the following:

"*If the project activity is the installation of a Greenfield power plant, the baseline scenario is 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 reflected in the combined margin (CM) calculations described in "TOOL07: Tool to calculate the emission factor for an electricity system*".

As Rondinha Small Hydroelectric Power Plant CDM project consists in the installation of a greenfield small hydro power plant, the baseline scenario is applicable to the project activity, as mentioned before.

According to items 283 and 286 of the CDM Project Standard (Version 3.0):

"*To demonstrate the validity of the original baseline or its update, project participants are not required to re-assess the baseline scenario. Instead, the project participants shall assess the GHG emission reductions or net anthropogenic GHG removals that would have resulted from that scenario.*

(…) If data and parameters used for determining the original baseline, that were determined ex ante and not monitored during the crediting period, are no longer valid, the project participants shall update such data and parameters in accordance with the "Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.""

The methodological tool TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1) provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism.

The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.

Step 1: Assess the validity of the current baseline for the next crediting period

The "Procedures for the renewal of the crediting period of a registered CDM project activity" approved by the CDM Executive Board requires assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

As mentioned before, the baseline is "If the project activity is the installation of a Greenfield power plant, the baseline scenario is 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 reflected in the combined margin (CM) calculations described in "TOOL07: Tool to calculate the emission factor for an electricity system".

There are no relevant mandatory national and/or sectoral policies which have come into effect after registration of the project activity that impact the baseline scenario. The current baseline complies with relevant mandatory national and/or sectoral policies, especially from the Brazilian Energy Sector and Environmental Laws.

In Brazil, there is no law that constrains electricity generation based in any electricity source neither construction of greenfield power plants. This is evidenced by the 2031 Decennial Electricity Expansion Plan[18] which shows that the planning for the electricity generation expansion in Brazil includes all currently existing energy sources showing that the additional electricity generated by

[18] https://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/plano-decenal-de-expansao-de-energia-2031

the project would be generated by existing or new power plants connected to the national electric system.

The operation of centralized power plants dispatched in the national interconnected system are subject to the ONS grid procedures[19]. There is no restriction in this grid procedures which avoids the continuation of the current situation where additional electricity generated by the project would be generated by existing or new power plants connected to the national electric system. Furthermore, there are environmental requirements for each energy sources as presented by Federal Resolution CONAMA 001/1986[20].

In the first crediting period, the project electricity system was the National Interconnected System (SIN), defined as the relevant grid to the project activity. The definition of the SIN as the relevant electricity system is also recommended by Brazilian DNA through Resolution N° 08 of May/2008, which defines the National Interconnected System as a single system that shall be used for the calculation of CO_2 emission factors.

Brazilian DNA calculates the CO_2 emission factors and publishes it through its website[21]. In the second crediting period, the project activity will follow the same definition of the project electricity system and use emission CO_2 emission factors published by Brazilian DNA.

Step 1.2: Assess the impact of circumstances

There are no circumstances that impact the baseline scenario.

During the second crediting period, the combined margin emission factor of the National Interconnected System will be calculated, according to the latest version of "TOOL07: Tool to calculate the emission factor for an electricity system".

The Combined Margin (CM) emission factor is calculated based on data of all plants connected to the National Interconnected System (SIN) and centrally dispatched by the National Interconnected Power System Operator (*Operador Nacional do Sistema - ONS*). Based on this generation data as provided by ONS, the Brazilian Designed National Authority (DNA) calculates OM emission factors of the SIN according to the "TOOL07: Tool to calculate the emission factor for an electricity system" and makes them available to the public.

For the second crediting period, the build margin emission factor is calculated ex ante and fixed for the whole crediting period, according to option chosen by project participants using the TOOL07: "Tool to calculate the emission factor for an electricity system" (Version 7.0). All details about steps of this Tool are presented at section B.6. This section presents the emission factors and baseline calculations, following TOOL07: Tool to calculate the emission factor for an electricity system.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

This step does not apply, since in the absence of the project, the electricity would be generated by grid connected power plants. Power plants connected to the system would continue to supply energy independently of the technical lifetime of the equipment applied to the project.

[19] http://www.ons.org.br/paginas/sobre-o-ons/procedimentos-de-rede/vigentes

[20] http://www.ima.al.gov.br/wizard/docs/RESOLU%C3%87%C3%83O%20CONAMA%20N%C2%BA001.1986.pdf

[21] Source: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao

Regarding the project lifetime, the project has 30 years lifetime, as indicated by registered PDD. The operational starting date of the plant was 04/06/2014. Therefore, the remaining lifetime exceeds the end of second crediting period.

Step 1.4: Assessment of the validity of the data and parameters

Detailed description of data, parameters and emission factors used to baseline calculations are presented at section B6.

According to TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1), project participants shall assess whether data and parameter that were only determined at the start of the crediting period and not monitored during the crediting period are still valid.

According to the methodological tool "Tool to calculate the emission factor for an electricity system" Version 07.0, for hydropower generation project activities the Weighting of operating margin emissions factor and the Weighting of build margin emissions factor are, respectively, 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. Therefore, for the second crediting period, it will be used W_{OM} = 0.25 and W_{BM} = 0.75.

PDD registered establishes that **EFgrid,CM,y** is ex -post calculated by project participants based on $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ published by Brazilian DNA. For the second crediting period, $EF_{grid,BM,y}$ is calculated ex ante and fixed for the whole second crediting period, according to TOOL07: "Tool to calculate the emission factor for an electricity system" (Version 07.0). $EF_{grid,OM,y}$ will still be calculated on ex-post basis according to TOOL07: "Tool to calculate the emission factor for an electricity system" (Version 07.0).

Step 2: Update the current baseline and the data and parameters

The application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline is still valid for the subsequent crediting period. The baseline scenario does not need to be reassessed.

However, for the second crediting period, $EF_{grid,BM,y}$ is calculated ex ante, according to TOOL07: "Tool to calculate the emission factor for an electricity system" (Version 7.0). The build margin emission factor is calculated by Brazilian DNA[22]. Data from 2021 calculated and published by the Brazilian DNA will be used for the Build Margin emission factor. The 2021 data vintage was adopted for the build margin calculation as these are the latest data made publicly available by the Brazilian DNA. The value is 0.0540 tCO2e/MWh.

The Operating Margin (OM) Emission Factor will be ex post calculated and it is a monitored parameter. Also the quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* ($EG_{facility,y}$) is a monitored parameter necessary to estimate baseline emissions. For the second crediting period, it was used 48,005 MWh/year as defined by MME Decree issued in 21/03/2014.

Step 2.1: Update the current baseline

The application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the baseline scenario is still valid. There is no need to be updated.

According to TOOL11: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1), project participants shall update

[22] For more information: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao

the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario.

Ex ante baseline emission estimation was updated according to “Tool to calculate the emission factor for an electricity system” Version 07.0. Equations and values applied are presented at section B.6. Table below summarizes ex ante baseline emission estimation for the second crediting period:

Table 3: Ex ante baseline emissions estimation

Year	(t CO2 e)
2022	9,127
2023	9,127
2024	9,127
2025	9,127
2026	9,127
2027	9,127
2028	9,127
Total	**63,889**

Step 2.2: Update the data and parameters

Brazilian DNA provides yearly updated data about emissions from National Interconnected System power generation. The latest available data are for OM and BM, considering the complete year, are from 2021. They were used to undertake the emission factors updates.

At PDD registered for the first crediting period, the values used to calculate ex ante emission reduction estimation were: for $EF_{grid,OM::}$ 0.2919 tCO2e/MWh and for $EF_{grid,BM}$**:** 0.1056 tCO2e/MWh. For the second crediting period, for ex ante emission reduction estimation, 2021 values were used. $EF_{grid,OM.2021}$ Value is 0.5985 tCO2e/MWh. $EF_{grid,BM,y}$, value of 2021 is also used which it is a fixed value for the whole second crediting period: 0.0540 tCO2e/MWh.

B.5. Demonstration of additionality

According to the CDM Project Standard for Project Activities (version 03.0) “for renewal of crediting period of a registered CDM project activity, the project participants are not required to reassess the additionality of the project activity nor update the section of the PDD relating to additionality”.

Therefore, this section is not applicable for the renewal of the crediting period. The original demonstration of additionality presented at PDD registered is presented as follows. There are just changes in the number of the tables to comply with numbering of this PDD version.

Section presented at the PDD Registered. As the registered PDD for the first crediting period did not number tables of this section, the same approach was followed in this PDD to keep the same structure.

“Consistent with ACM0002/Version 14.0, the additionality of the bundled project activity shall be demonstrated and assessed using the “Tool for the demonstration and assessment of additionality” version 7.0.0, as described below:

Prior Consideration

Since the start date of the project is after August 2nd, 2008 and as per the “GUIDELINES ON THE DEMONSTRATION AND ASSESSMENT OF PRIOR CONSIDERATION OF THE CDM” version 4

(EB 62 Annex 13), the project proponent informed in writing to the DNA and the EB as per required on the guidelines.

Date	Event
October 2007	Basic Project performed by RTK
June 2008	EAS (Simplified Environmental Study) performed by RTK
March 2009	PCH Rondinha financial analysis performed by MS engineering (Investment Decision Date)
12 May 2009	Preliminary License issued by FATMA
July 2009	Hiring of CDM consultant
24 July 2009	**CDM prior consideration letters DNA (Date of prior consideration)**
29 July 2009	**CDM prior consideration letters UNFCCC (Date of prior consideration)**
2 October 2009	Installation License Issuance by FATMA
19 May 2010	**4 PPA's signed with Tramontina's group subsidiaries (Start Date) (Investment Decision Date)**
5 October 2010	ANEEL authorization for the first PBO
27 April 2011	Request for financing BNDES (Letter sent to BRDE Bank)
27 April 2011	Contract with "Impacto Assessoria Ambiental" in order to perform the programs defined in the EAS
May 2011	New PBO developed by VLB
15 June 2011	Contract to acquire the Turbines, Generators and all the related equipment signed
02 December 2013	Operational License Issuance by FATMA

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

Not applicable.

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

Sub-step 1a: Define alternatives to the project activity
There are two realistic and credible alternative scenarios available to the project activity:

Scenario 1: The proposed project activity undertaken without being registered as a CDM project activity.

Scenario 2: The continuation of the current situation (no project activity undertaken).

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

All the alternatives and the project activity accomplishes with the mandatory laws and regulations.

Step 2: Investment analysis

According to the "Tool for the demonstration and assessment of additionality" the investment analysis has been selected.

Sub-step 2a . Determine appropriate analysis method

A benchmark analysis (Option III) was selected as the most appropriate analysis method to consider.

Sub-step 2b . Option III. Benchmark analysis

For the investment analysis, the Equity Internal Return Rate (IRR) has been chosen as the suitable financial/economic indicator of the project. A comparison of the Equity IRR with a selected benchmark (cost of equity) will be used to demonstrate that the project needs the carbon finance incentive.

The investment decision date is considered as **19/05/2010**, in where the project proponent signs a PPA with several clients.

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

Benchmark: Post tax real cost of equity

The project proponent selected the cost of equity calculation, based on the CAPM methodology and the guidelines for this calculation issued by the "Fundação Getulio Vargas"[23]

$$Ke = Rf + Beta(Rm - Rf)$$

The risk free considers two components: first the risk free rate from US bonds and second the Brazilian risk, a value that is not included in the US bonds.

The risk free rate from US bonds considers one year average of the bond of 20 years maturity, being this value 4.45%. Since this value is nominal it must be converted to real by calculating the expected inflation forecast, by using the U.S. Treasury securities at 20-year and the U.S. Treasury securities at 20-year inflation-indexed, and therefore the inflation has a value of 2.30%.

$$Rfusa = \left(\frac{1 + 4.45\%}{1 + 2.30\%}\right) - 1 = 2.10\% \, (Real)$$

In the case of the Brazilian risk (Page 17) [20], it's recommended a 5 years average of the "EMBI+Brazil", being this value 2.67%.

Then the final value for Rf is equal to 4.77% (2.10% + 2.67%).

Rm-Rf

This formula (Page 17) corresponds to the average annual return of shares minus the return of the American T bonds. As recommended, the average is taken from 1928 to the investment decision year. The value of Rm corresponds to 11.32% and the Rf for this case is 5.28%, being Rm-Rf equal to 6.03%.

This formula (Page 17) corresponds to the average annual return of shares minus the return of the American T bonds. As recommended, the average is taken from 1928 to the investment decision year. The value of Rm corresponds to 11.32% and the Rf for this case is 5.28%, being Rm-Rf equal to 6.03%.

[23] http://www.abce.org.br/downloads/ingleswacc.PDF

Beta

From the full list of companies traded, it´s selected the ones related with the power sector. The weighted levered beta for the sector is 2.47 (calculated), and this value unlevered is 0.82 (calculated). The following formula is used for lever the beta considering the situation of Brazil:

$$Beta = Bu\left[1 + (1 - t)\left(\frac{Wd}{We}\right)\right]$$

Bu=0.82 (calculated)
t=0% (Marginal Tax Rate equal to zero since the project proponent is assuming a profit for the tax calculation)
Wd=66.92% (average 2003-2011 BNDES support)
We=33.08% (average 2003-2011 BNDES support)

$$Beta = 0.82\left[1 + (1 - 0\%)\left(\frac{66.92\%}{33.08\%}\right)\right] = 2.47$$

Calculation of the benchmark

$$Ke = Rf + Beta(Rm - Rf) = 4.77\% + 2.47(6.03\%) = 19.70\%$$

Then the real cost of equity corresponds to 19.70%.

Investment Analysis

To be in line with the selected benchmark, it´s calculated the post-tax real equity IRR.

Investment Data Rondinha

Parameter	**Value**	**Reference Documentation**
Capacity (MW)	9.6[24]	PPA Signed on 19/05/2010
Energy Price (R$/MWH)	150	PPA Signed on 19/05/2010
Yearly Generation (MWh)	53,611	Basic Engineering project dated 2007, this information was used since it´s before the investment decision date. The one presented to the bank in 2011 is higher, and therefore this value is conservative.
Investment (R$)	57,907,824	Several documents, presented in the investment analysis.
O&M (thousand R$/year)	441,320	Hydroelectric Inventory Manual of Hydrographic Basins Electrobras, 2007
End of concession	31/12/2040	Authorizing Resolution ANEEL 2568, 2010

[24] The financial analysis considered the rounded value of 9.6 MW.

Parameter	Value	Reference Documentation
Taxes		
PIS + COFINS	3.65%	Law n° 10.637/2002, 10.833/2003 and 10.865/2004
INCOME TAX	34%	Composed as 9% of CSLL (Tax of Social Contribution), plus 15% of income tax and also an extra 10% for profits over R$ 240,000/year.
TUSD (R$/kW/Month)	1.16	Ratifying Resolution Nº 1.037,2010
ANEEL TAX (TFSEE)	0.5% of 363.60 R$/kW	DESPACHO Nº 4774, 2009 (Typical annual unit economic benefit (R$)). DECRETO Nº 2.410,1997 (charge % 0.5%)
Loan		
Debt (R$)	46,326,259	This is the maximum possible request to BNDES (source from 2010), which is 80% of the total. The value after the investment decision date was 71%, which gives an IRR of 14.20, lower than the calculated.
Interest Rate (%)	8.92%	Long Interest Rate from 2010 (6%) (Source 2010, BNDES) + BNDES Spread (0.9%) (Source 2010, Porto Conference) + Credit risk rate (2.02%) (Source 2010, Porto Conference)

Post Tax equity IRR. The computed real post tax equity IRR of the project is 16.64% for the project ***Rondinha*.** Considering the contribution of the CER, the computed real post tax equity IRR of the project is 18.19%.

Sub-step 2d. Sensitivity analysis

A sensitivity analysis was performed to verify the soundness of the financial model and of its indicators. The post-tax, real, equity based IRR without CERs was reassessed upon potential variations in four variables: energy prices, PLF, investment and operational cost, based on the fact that they represent either more than 20% of investment costs or more than 20% of income.

Sensitivity Analysis based on default Limits of +/- 5% and +/- 10%

The Table and graph below show the IRR of the project for default limits of 5% and 10%, as well as -5% and -10% applied to the four variables:

Rondinha

	IRR with a 10% decrease	IRR with a 5% decrease	Equity IRR	IRR with a 5% increase	IRR with a 10% increase
Change in Project Power Generation	12.83%	14.68%	16.64%	18.72%	20.93%
Change in Energy Price	12.83%	14.68%	16.64%	18.72%	20.93%
Change in Investment	19.20%	17.91%	16.64%	15.37%	14.09%
Change in O&M	16.87%	16.75%	16.64%	16.53%	16.41

Sensitivity Analysis based on reaching the Benchmark

The table below shows the decrease or increase of the variables needed for the IRR to reach the benchmark:

TABLE *Rondinha*

	Decrease needed to reach the benchmark	Benchmark	Equity IRR	Benchmark	Increase needed to reach the benchmark
Change in Project Power Generation	-	19.70%	16.64%	19.70%	7.24%
Change in Energy Price	-	19.70%	16.64%	19.70%	7.24%
Change in Investment (INV)	-11.92%	19.70%	16.64%	19.70%	-
Change in O&M (max limit -100%)	-100.00%	19.70%	16.64%	19.70%	-

This project would reach the benchmark if one the following circumstances would take place:

1/ The Power Generation is 7.24% higher than anticipated. The PLF estimation was done based on historical statistics of long term, and therefore is unlikely that this situation could happen. The information used for the IRR calculation, was based on a report of 2007, since it is prior the start date of the project, being the PLF from this source 63.75%. However, in the loan request to BNDES (sourced from 2011) this value is 61.23%, and therefore to reach the benchmark an increase of 11.69% is needed.

2/ The Energy Price is 7.24% higher than the expected price. This situation is unlikely since the prices indicated in the present analysis are based on the PPA signed with some clients.

3/ The Investment would have to be 11.92% lower than expected. The project owner took its decision in May 19th, 2010. In April 2011, the requested amount to the bank was R$ 68,211,203 higher to the current investment analysis and therefore this situation is unlikely to happen. This request of the loan, was based on the strength of a financial investment study delivered to BRDE ("Regional Bank of Development"). Price differences may take place, but they would probably not

reach a negative adjustment as substantial especially since inflation has been positive on the following years, prices of the equipment are rising due to the economy adjustments, etc.

4/ The O&M costs have a limited impact on the IRR. Even with O&M going up 10%, as per requested on the sensitivity analysis, the IRR of both projects doesn't reach the benchmark.

As a result, it´s highly unlikely that the equity IRR will surpass the benchmark under all reasonable circumstances and therefore it can be considered as financially unattractive under the CDM rules.

Step 3: Barrier analysis

According to the rules of the additionality analysis, it is not necessary to perform the analysis of barriers, if opting for the financial analysis as is the case here, and therefore step 3 does not apply.

Step 4: Common practice analysis

The "Guidelines on common practice", EB69 Annex 08, Version 2 is used for the analysis, as per required on the tool of additionality.

Sub-step4a. The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above

Measure

As per the "Guidelines on common practice", this type of projects falls in the measure (b) "Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies)" (paragraph 2 of the guidelines).

Stepwise approach for common practice

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

Since Rondinha have an installed power of 9.5994 MW[25], the comparison will be with plants with a power capacity range of -50% to +50%, therefore between 4.8MW and 14.4MW.

Step 2: Step 2: identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

(a) The projects are located in the applicable geographical area;

Brazil is a country that has an important extension, with a land size of 8,459,417 km2, which is only 12% smaller than China.

[25] The common practice considered the rounded value of 9.6 MW of installed capacity.

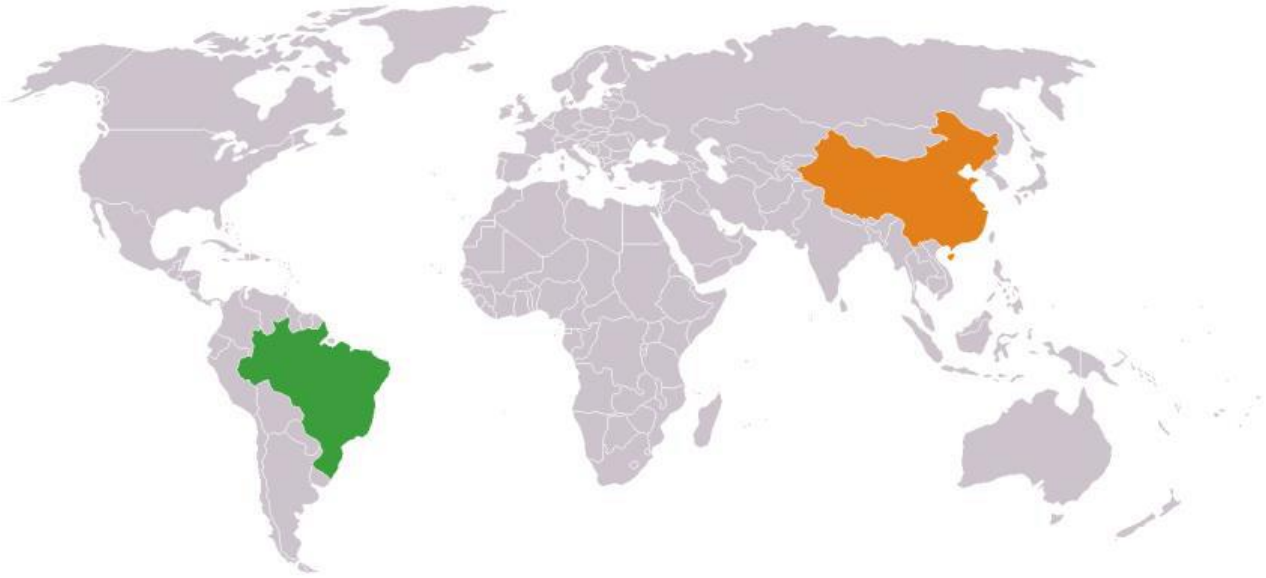

Figure: Brazil versus China[26]

Because of this extension, it has differences on the types of climate and resource availability, among the Regions, in where 6 different climates are in the same country. Moreover, the availability of the resource among the regions is completely different, as presented in the following figures.

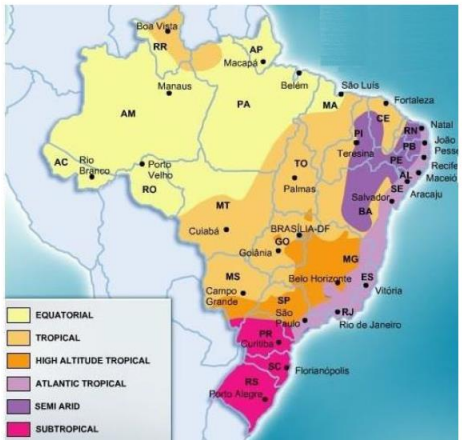

Figure: Climate Zones

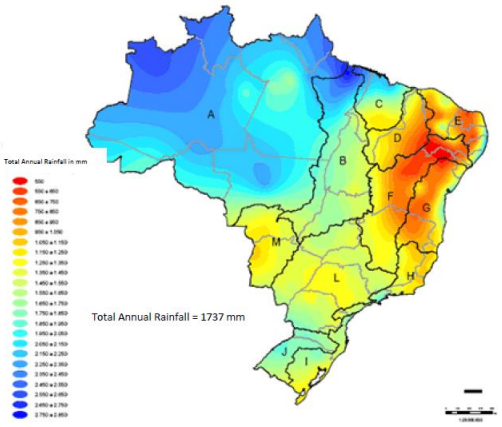

Figure: Total Yearly Rainfall Brazil[27]

In addition, the country is divided in macro regions by the Brazilian Institute of Geography and Statistics, as can be observed in the following map.

[26] PDD registered for the first crediting period.

[27] PDD registered for the first crediting period.

Figure: Regions in Brazil[28]

Because of these arguments, in where the local conditions between the regions are different, the selected region is the south area, in where the project is located.

(b) The projects apply the same measure as the proposed project activity;

As per the “Guidelines on common practice”, these projects falls in the measure (b) “Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies)” (paragraph 2 of the guidelines).

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

The project is not a technology switch measure.

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

All the plants produce electrical energy that is a comparable product.

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

The included power plants will be between 4.8MW and 14.4MW

(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

The start date of the project is considered as 19/05/2010 and the publication for stakeholder consultation was 08/02/2012. Therefore, the earliest date is 19/05/2010.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number Nall.

[28] PDD registered for the first crediting period.

The total amount of operative generating units in Brazil, that fulfill all the conditions of Step 2, from (a) to (f), and that are not CDM project activities are:

Type of Unit	Quantity
PCH	2
PCH-PROINFA	3
PCH-NON PRE MARCH 2004	7
UHE	0
Nall	12

PCH - Small Hydroelectric Plant
PCH - PROINFA Small Hydroelectric Plant with the incentive of PROINFA
PCH PRE MARCH 2004 - Small Hydroelectric Plant that started before March 2004 without PROINFA
UHE - Hydroelectric Energy Plant

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number Ndiff.

As per the guidelines, different technologies can be the following:

1) Subsidies or other financial flows (PROINFA): Many of the PCH projects enjoy the benefits of the PROINFA program. This program aimed to add 3,300 MW of installed capacity through small-hydro power plants, wind-power, and biomass energy generation. The scheme offered long-term contracts with special conditions, lower transmission costs, and smaller interest rates from the local development banks. In 2005, a revised version of PROINFA was released with the requirement that any CERs generated from participating projects would be given to Eletrobrás. Under PROINFA, projects had to be fully operational by the end 2008. These types of projects have been named PCH-PROINFA in the list.

2) Promotional policies (Plants that are UHE): The TUSD has two components: (i) the remuneration of the concessionaire for the exclusive use of the local network, called "TUSD-Serviço" (Service TUSD), which varies depending on the amount used by customer demand, and (ii) the regulatory costs applicable to the use of local network called "TUSD-Encargos" (Charge TUSD), established by regulatory authorities, and is related to the amount of energy consumed by the consumer. The plants that are categorized as UHE (Hydroelectric power Plants or HPP) have a total discount of the "TUSD-Encargos", besides, for UHEs, the operation of transmission and distribution is coordinated by the National Electric System Operator - ONS. The grids of low voltage (below 230 kV), which comprises the PCHs, usually serve at a regional (distribution networks) and their coordination and operation are performed by the local distribution utility. Therefore, the "ONS" is only responsible for UHEs. Besides, The UHEs have to pay the CFURH tax[29]

3) Legal Regulations (Projects in operation before March 2004): As different projects, it will be considered those that are operational before March 2004 (main reform in the market) and before the start date of the project, since before 2004 the investment climate was different.

[29] Compensação Financeira pela Utilização de Recursos Hídrico (Compensation for Use of Water Resources); see the link for more info: http://www.furnas.com.br/CFURH_arquivos/Relatorio_CFURH_2010.pdf

It took years for the electric sector in Brazil to become a modern industry. It started its reform in 1993 by ending the equality of the tariff and creating supply contracts between generators and distributors. By 1995 this reform became sounder when concepts of independent energy producers and free consumers were created and finally in 1996 the Ministry of Mines and Energy implemented a restructuration project for the electric sector in Brazil. The main results of the restructuration project were the switching from a monopolist and state-owned system to a competitive and more balanced state-private system. This restructuration project was finished in 1998 and set a conceptual and institutional model for the Brazilian electric sector, where several needs were identified and fulfilled, like the division of generation, transmission and distribution segments, regulation for the distribution and transmission of electric energy, creation of a regulatory entity (ANEEL), an operator of the system (ONS) and a space to trade electric energy (MAE). At that time, the Brazilian government decided to reduce the country's dependence on hydropower by the increase of thermoelectric generation. The federal government launched in early 2000 the Thermoelectric Priority Plan (Plano Prioritário de Termelétricas, PPT) planning the implementation of thermoelectric plants using mainly natural gas. In 2001 the sector went through a massive supply crisis that ended in an electric energy rationing program and in an adjustment of the model used until then. This situation led to the analysis of the model and in 2004, the newly elected government reviewed the institutional rules of the electric market and proposed a new model which was approved by the congress in March 2004[30]. The 2004 model was implemented to reduce market risks. Several institutions were created: (i) EPE[31] to be responsible for the long term planning of the electric sector, (ii) CMSE[32] to ensure the supply of energy and (iii) CCEE[33] to help with the activities related to commercialization of energy

Type of Unit	Quantity
PCH-PROINFA NON-CDM	3
PCH-NON PROINFA NON CDM PRE 2004	7
UHE	0
Ndiff	10

Step 5: calculate factor F=1-Ndiff/Nall representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

F= 1 - 10/12 = 0.17 (lower than 0.2)

And

N_{all}-N_{diff} = 2 (under 3)

[30] PDD registered for the first crediting period.

[31] PDD registered for the first crediting period.

[32] PDD registered for the first crediting period

[33] PDD registered for the first crediting period

According to the tool, the proposed project activity is a common practice if the factor F is greater than 0.2 and N_{all}-N_{diff} is greater than 3. In this case, since F is lower than 0.2 the project does not comply with those values; therefore, it is not a common practice project."

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

According to ACM0002 methodology (version 20.0), the emission reductions (ER_y) are calculated as follows:

$$ER_y = BE_y – PE_y$$

Where:
ER_y = Emission reductions in year *y* (tCO_2e/yr);
BE_y = Baseline emissions in year *y* (tCO_2/yr);
PE_y = Project emissions in year *y* (tCO_2e/yr).

BE_y Calculation (Baseline emissions in year y (tCO_2/yr))

ACM0002 methodology, version 20.0, 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 calculated as follows:

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

Where:
BE_y = Baseline emissions in year *y* (tCO_2/yr);
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr);
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of "TOOL07: Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

If the project activity is the installation of Greenfield power plants, then:

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

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

To determine the $EG_{facility,y}$ ***ex-ante*** calculation, it was considered the estimated quantity of net electricity generation supplied by the project plant/unit to the grid: 48,005 MWh/year.

To calculate $EF_{grid, CM, y}$ it will be used the data provided by the Brazilian DNA, which provides data of the operating margin emission and the build margin emission factors by dispatch analysis using "TOOL07: Tool to calculate the emission factor for an electricity system", published by Brazilian DNA.

The steps recommended by "TOOL07: Tool to calculate the emission factor for an electricity system", version 07.0, are discussed below.

Step 1: Identify the relevant electricity systems

According to the "TOOL07: Tool to calculate the emission factor for an electricity system", version 07.0, project participants may delineate the project electricity system using any of the following options:

(a) Option 1. A delineation of the project electricity system and connected electricity systems published by the DNA or the group of the DNAs of the host country(ies), In case a delineation is provided by a group of DNAs, the same delineation should be used by all the project participants applying the tool in these countries;

(b) Option 2. A delineation of the project electricity system defined by the dispatch area of the dispatch centre responsible for scheduling and dispatching electricity generated by the project activity. Where the dispatch area is controlled by more than one dispatch centre, i.e. layered dispatch area, the higher level area shall be used as a delineation of the project electricity system (e.g. where regional dispatch centres are required to comply with dispatch orders of the national dispatch centre then area controlled by the national dispatch centre shall be used);

(c) Option 3. A delineation of the project electricity system defined by more than one independent dispatch areas, e.g. multi-national power pools.

Option 1 is chosen. The National Interconnected System (SIN) is defined as the relevant grid to the project activity. The definition of the SIN as the relevant electricity system is also recommended by the DNA through Resolution N° 08 of May/2008, which defines the National Interconnected System as a single system that shall be used for the calculation of CO_2 emission factors.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

The option I was chosen for the project activity, once the Operation Margin and Build Margin emission factor are calculated by the Brazilian DNA. The Brazilian DNA publishes[34] the emission factor calculation based on Option (i) above.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple Operation Margin; or
(b) Simple adjusted Operation Margin; or
(c) Dispatch data analysis Operation Margin; or
(d) Average Operation Margin.

The method chosen to calculate Operation Margin emission factor is the dispatch data analysis operation margin method.

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

[34] Source: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao

The method chosen for operation margin emission factor calculation is the dispatch data analysis calculated on an ***ex-post*** basis.

As previously stated, the Operating Margin (OM) emission factor ($EF_{grid,OM-DD,y}$) calculation based on the dispatch data analysis method is currently conducted by the Brazilian DNA, in accordance with the dispatch data provided by the National Interconnected Power System Operator (ONS).

According to the "*Tool to calculate the emission factor for an electricity system*", version 07.0, 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. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

Dispatch data OM emission factors for 2021 will be used for an ***ex-ante*** CERs estimation of the second crediting period.

Step 5: Calculate the build margin emission factor

In terms of the vintage of data, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor ex ante 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. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period;

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. **For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above**. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The option that was chosen by project participants was Option 2.

The build margin emission factor is calculated by the Brazilian DNA[35]. 2021 Data will be used for the Build Margin emission factor once these are the latest data made publicly available by the Brazilian DNA.

Step 6: Calculate the combined margin emission factor

The calculation of the Combined Margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average Combined Margin; or
(b) Simplified Combined Margin.

[35] For more information: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao

This project activity used option (a) to calculate the combined margin emission factor. The combined margin emission factor is calculated according to the following equation:

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

Where:
$EF_{grid,CM,y}$ = Combined 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)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/ MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

According to *Tool to calculate the emission factor for an electricity system*", version 07.0, the following default values should be used for W_{OM} and W_{BM}: (a) Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods; (**b) All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period**, unless otherwise specified in the approved methodology which refers to this tool.

Therefore, the following values will be used during the second crediting period: **W_{OM} = 0.25 and W_{BM} = 0.75.**

PE_y Calculation (project emissions in year y (tCO_2e/yr))

According to ACM0002 methodology, version 20.0, for most renewable power generation project activities, PE_y = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted as project emissions by using the following equation:

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

Where:
PE_y = Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$ = Project emissions from the operation of dry, flash steam or binary geothermal power plants in year *y* (tCO_2e/yr)
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr).

For this project activity, $PE_{FF,y}$, and $PE_{GP,y}$ are zero. $PE_{HP,y}$ is also zero once the power density of the project is higher than 10 W/m^2 as demonstrated in table 2 of this PDD.

Therefore, the project does not generate any associated project emissions.

Leakage

No leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

Project Emissions Reductions

According to ACM0002 methodology (version 20.0), the emission reductions (ER_y) are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:
ER_y = Emission reductions in year *y* (tCO_2e/yr);
BE_y = Baseline emissions in year *y* (tCO_2/yr);
PE_y = Project emissions in year *y* (tCO_2e/yr).

As there is no project emissions ($PE_y = 0$), emission reductions achieved by the project can be calculated according as follows: $ER_y = BE_y = EG_{facility,y} * EF_{grid,CM,y..}$

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr);
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid 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 "TOOL07: Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

Consequently, the emission reductions generated by the project activity are calculated as the product between the quantity of net electricity supplied by the project activity to the grid and the Combined Margin (CM) emission factor, where the Operating Margin (OM) emission factor will be calculated according to the Dispatch Data Analysis annually updated and the Build Margin (BM) emission factor defined ex-ante (Option 2) considering 2021 data vintage, which was the latest BM available information provided by the Brazilian DNA at the time of the conclusion of this PDD.

For the second crediting period, weights considered for Combined Margin Emission Factor are: 25% for the Operating Margin and 75% for Build Margin.

B.6.2. Data and parameters fixed ex ante

Data/Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/ MWh
Description	Build margin CO_2 emission factor in year *y*
Source of data	Brazilian DNA, BM emission factor for the year 2021.
Value(s) applied	0.0540
Choice of data or measurement methods and procedures	Build margin CO_2 emission factor is calculated and published by the Brazilian DNA. 2021 data vintage was adopted for build margin calculation as this is the latest data available.
Purpose of data	Calculation of baseline emissions.
Additional comment	For methodological choices details, please refer to section B.6.1.

Data/Parameter	GWP_{CH4}
Data unit	$t\ CO_2e/t\ CH_4$
Description	Global warming potential of methane valid for the relevant commitment period
Source of data	IPCC
Value(s) applied	For the first commitment period: 21 $t\ CO_2e/t\ CH_4$ For the second commitment period: 25 $t\ CO_2e/t\ CH_4$
Choice of data or measurement methods and procedures	Default value provided by IPCC as indicated by ACM0002 methodology, version 20.0
Purpose of data	Calculation of baseline/project emissions.
Additional comment	This project activity does not provide project emissions.

Data/Parameter	EF_{Res}
Data unit	$kgCO_2e/MWh$
Description	Default emission factor for emissions from reservoirs
Source of data	Decision at EB 23
Value(s) applied	90 $kgCO_2e/MWh$
Choice of data or measurement methods and procedures	Default value provided by ACM0002 methodology, version 20.0.
Purpose of data	Calculation of project emissions
Additional comment	This project activity does not provide project emissions.

Data/Parameter	Cap_{BL}
Data 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	Rondinha Small Hydroelectric Power Plant site
Value(s) applied	0
Choice of data or measurement methods and procedures	Rondinha is a greenfield hydro power plant, therefore, as per methodology, this value is zero.
Purpose of data	Calculation of project emissions
Additional comment	This project activity does not provide project emissions.

Data/Parameter	A_{BL}
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero
Source of data	Rondinha Small Hydroelectric Power Plant site
Value(s) applied	0
Choice of data or measurement methods and procedures	Rondinha is a greenfield hydro power plant. Therefore, as per methodology, this value is zero.
Purpose of data	Calculation of project emissions
Additional comment	This project activity does not provide project emissions.

Data/Parameter	W_{OM}
Data unit	%
Description	Weighting of operating margin emissions factor (%)
Source of data	TOOL07: Tool to calculate the emission factor for an electricity system" (Version 7.0)
Value(s) applied	25%
Choice of data or measurement methods and procedures	Default value for hydropower plants in the second crediting period.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data/Parameter	W_{BM}
Data unit	%
Description	Weighting of build margin emissions factor (%)
Source of data	TOOL07: Tool to calculate the emission factor for an electricity system" (Version 7.0)
Value(s) applied	75%
Choice of data or measurement methods and procedures	Default value for hydropower plants in the second crediting period.
Purpose of data	Calculation of baseline emissions.
Additional comment	

B.6.3. Ex ante calculation of emission reductions

As previously stated, for this project activity emissions both PE_y and the Leakage are 0 (zero). Therefore, the emission reductions can be calculated according to equation below:

$ER_y = BE_y = EG_{facility,y} * EF_{grid,CM,y}$

Where:
ER_y = Emission Reductions in year *y* (tCO_2e/yr)
BE_y = Baseline emissions in year *y* (tCO_2/yr);
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid 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 "TOOL07: Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

The parameters used for *ex-ante* calculations are compiled in Table 4.

Table 4: Parameters used for ex-ante calculations.

Parameter	Unit	Value	Description	Comment
ER_y	tCO_2/yr	9,127	Emissions reductions in the year y	Calculated
BE_y	tCO_2/yr	9,127	Baseline emissions in year y	Calculated
PE_y	tCO_2/yr	0	Project emissions in the year y	As per ACM0002/Version 20.0, this project activity does not present project emissions.
$EG_{PJ,y} = EG_{facility,y}$	MWh/yr	48,005	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	The expected quantity of net electricity generation that is produced and fed into the grid of 48,005 MWh was based on MME Decree, issued in 21/03/2014.
$EF_{grid,CM,y}$	tCO_2/MWh	0.1901	Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of "TOOL07: Tool	Calculated accordingly formula (8) in section B.6.1 of this PDD, as stated in the TOOL07: Tool to calculate the emission factor for an electricity system, version 02.2.1.

Parameter	Unit	Value	Description	Comment
			to calculate the emission factor for an electricity system" (tCO2/MWh)	
$EF_{grid,OM,y}$	tCO_2/MWh	0.5985	Operating margin CO2 emission factor in year y	Operating margin emission factor of the National Interconnected System (2021), as published by the Brazilian DNA (https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao)
$EF_{grid,BM,y}$	tCO_2/MWh	0.0540	Build margin CO_2 emission factor in year y	Build margin emission factor of the National Interconnected System (2021), as published by the Brazilian DNA (https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao)
w_{OM}	Fraction	0.25	Weighting of operating margin emissions factor	Default value for the second crediting period of hydro-based electricity generation projects, as per TOOL07: Tool to calculate the emission factor for an electricity system (Version 7.0)"
w_{BM}	Fraction	0.75	Weighting of build margin emissions factor	Default value for the second crediting period of hydro-based electricity generation projects, as per " TOOL07: Tool to calculate the emission factor for an electricity system (Version 7.0)"

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2022	9,127	0	0	9,127
2023	9,127	0	0	9,127
2024	9,127	0	0	9,127
2025	9,127	0	0	9,127
2026	9,127	0	0	9,127
2027	9,127	0	0	9,127
2028	9,127	0	0	9,127
Total	**63,889**	0	0	**63,889**
Total number of crediting years	7 years			
Annual average over the crediting period	9,127	0	0	9,127

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{facility,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generated and supplied by the project power plant to the grid in year *y*
Source of data	Direct measurement or calculated based on measurements from more than one electricity meters
Value(s) applied	48,005 MWh/yr
Measurement methods and procedures	This parameter will be continuously analyzed and monitored. Values will be aggregated monthly and yearly. There are two meters (one principal and one rear) at the grid interface (at Palmas Substation) to measure the electricity supplied to the grid. These meters will be calibrated as defined by ONS Grid Procedures (National Operator of the System). All data will be stored electronically on a daily basis over two years after the end of the crediting period. This parameter will be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. If it is calculated, then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid.
Monitoring frequency	Continuous measurement and at least monthly recording.

QA/QC procedures	Measurement obtained in the meters located at Palmas Substation will be crosschecked with the data provided by the Brazilian Electric Energy Commercialization Chamber (*CCEE – Câmara de Comercialização de Energia Elétrica*). This data is a third party and reliable information, since CCEE is the official Brazilian agency responsible for the activities and operations of the national electricity market. The electricity meter is subject to regular maintenance and testing in accordance with the stipulation of the meter supplier and/or as per the requirements set by the ONS procedures. The calibration of meters, including the frequency of calibration, will be done in accordance with ONS Procedures. The accuracy class of the meters will also follow the stipulation of the meter supplier and/or as per the requirements set by the ONS or national requirements.
Purpose of data	Calculation of baseline emissions
Additional comment	For ER_y projection, the expected quantity of net electricity generation that is produced and fed into the grid of 48,005 MWh was based on MME Decree, issued in 21/03/2014.

Data/Parameter	**$EF_{OM,DD,y}$**
Data unit	tCO_2/ MWh
Description	Operating margin CO_2 emission factor in year *y*
Source of data	Calculated by Brazilian DNA, Project Participants or third Parties.
Value(s) applied	0.5985
Measurement methods and procedures	***Ex-post*** operating margin emission factor will be calculated by the Brazilian DNA, by Project Participants or third parties, through ONS data. It will be calculated through the Dispatch Data of the National Interconnected System as per the "Tool to calculate the emission factor for an electricity system".
Monitoring frequency	Annual
QA/QC procedures	As per the "Tool to calculate the emission factor for an electricity system"
Purpose of data	Baseline emissions calculation
Additional comment	Value applied for ex ante emission reduction estimation was Operating margin CO_2 emission factor of year 2021 provided by Brazilian DNA.

Data/Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor in year *y*
Source of data	Brazilian DNA or ONS.
Value(s) applied	0.1901
Measurement methods and procedures	***Ex-post*** emission factor will be calculated by the Brazilian DNA, by Project Participants or third parties, through ONS data. The variable $EF_{grid,OM,y}$ necessary for $EF_{grid,CM,y}$ calculation will also be monitored and calculated through the Dispatch Data of the National Interconnected System. To be calculated as per the "Tool to calculate the emission factor for an electricity system".
Monitoring frequency	Annual
QA/QC procedures	As per the "Tool to calculate the emission factor for an electricity system"
Purpose of data	Baseline emissions calculation
Additional comment	Value applied has been calculated based on data provided by the Brazilian DNA for the Operating Margin and Build Margin values of year 2021 (the latest value of a complete year available at the time of the re-validation start). The BM value will be fixed for the entire second crediting period, while the OM and CM values shall be updated annually during the crediting period.

Data/Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Value(s) applied	9,599,400
Measurement methods and procedures	The installed capacity is based on manufacturer's specifications on the installed/rated capacity of the generator
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	Not applicable
Purpose of data	Not applicable
Additional comment	-

Data/Parameter	A_{PJ}
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Measured from topographical surveys, maps, satellite pictures, etc.
Value(s) applied	620,000 m^2
Measurement methods and procedures	This value is attested by environmental local entity responsible for licensing process.
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	Not applicable
Purpose of data	Not applicable
Additional comment	The latest Environmental Operational License 3370/2018 is the evidence for value used. The value applied includes the natural river channel.

B.7.2. Sampling plan

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There is no sampling plan involved in this project activity.

B.7.3. Other elements of monitoring plan

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1. General Considerations

The objective of the monitoring plan is to ensure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions achieved by the project activity during the whole crediting period. The entrepreneurs (that are the project developer and operator) will be responsible for the implementation of the monitoring plan, which is based in monitoring the net electricity dispatched to the grid and the emission factor of the electricity grid.

The power plant has two billing meters, a main one and one backup, for reading and keeping record of the electricity generation. Both meters operate in parallel and with the same functional characteristics, so in case of failure the remaining one will be operative. The calibration of the meters will be performed according to ONS Grid procedures and according to the maintenance guidelines of the equipment.

The information of quantity of net electricity generated and supplied by the project power plant to the grid in year will be saved in the server of the billing measurement software, which can be used whenever necessary.

This data will be crosschecked with the data provided by the Brazilian Electric Energy Commercialization Chamber (*CCEE – Câmara de Comercialização de Energia Elétrica*). This data is from a third party and reliable information, since CCEE is the official Brazilian agency responsible for the activities and operations of the national electricity market. Project operator will monitor this parameter continuously and data will be consolidated hourly and monthly. The operational area of Project owner will be responsible for continuous measurement and at least monthly recording.

Monthly values will be used for crosschecking electricity dispatched in the interconnection point with the Brazilian national grid and the data provided by CCEE. Records pertaining to the meters used in the project activity (type, model and calibration reports) will be kept accordingly.

Emission reductions calculation will be carried out by project operator or by third part consulting company. All reports will be archived until 2 years after the end of the Project crediting period.

Diagram below shows where the main monitored parameters will be obtained. $EF_{grid,CM,y}$ is calculated based on data supplied by Brazilian DNA.

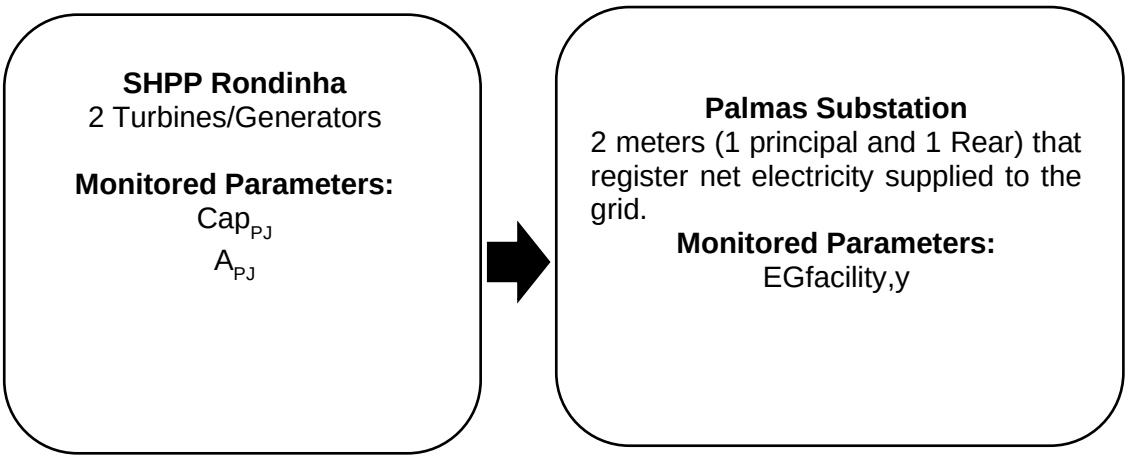

Figure 03 – Monitored Parameters

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

The starting date of a CDM project activity is defined in the CDM glossary as the earliest date at which either the implementation or construction or real action of a project activity begins.

The PP signed the contract to sell the energy on 19/05/2010, becoming this a real action taken to start the project activity and thus is regarded as the start date of the project. The construction started on January 2013 and the operations started on June 2014.

C.2. Expected operational lifetime of project activity

30 years and zero months.

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable (Second crediting period).

C.3.2. Start date of crediting period

01/01/2022

C.3.3. Duration of crediting period

>>
7 years and 0 months.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

The project participant, as per the environmental rules defined by the National Environmental Council (CONAMA[36]), is required to obtain three licenses on order to obtain the environmental permit to develop the hydroelectric power plant.

These are the Preliminary license (LP), where an environmental impact assessment is performed, the Construction License (LI), where requirements for the construction are established, and the Operating License (LO), where there is test before operation of the plant is performed to ensure that it fulfills all environmental requirements.

The project has performed an Environmental assessment according to the Federal and State legislation, following the rules stated by CONAMA in the Resolution No. 279, June 27, 2001 of the National Environment Council, which requires the implementation of the Simplified Environmental Report - RAS, or a Simplified Environmental Study (EAS) by FATMA (Fundação do Meio Ambiente de Santa Catarina), replacing the corresponding to the EIA / RIMA in case of alternative energy sources, the case of SHP.

Rondinha also meet the requirements of Instruction No. 44 of FATMA which states that plants with maximum installed power below 10 MW and that do not promote the removal of vegetation are allowed to perform a Simplified Environmental Study - EAS, replacing the EIA / RIMA.

The EAS evaluates the main effects in the environment that can be identified and analysed for the planning, implementation and operation periods, considering the project's characteristics and its influence area. The latest operational License issued for Rondinha Hydroelectric Power Plant is Operational License 3370/2018. In 15/12/2021, project owners requested for Operational License renewal which is evidenced by protocol "FCEI Nº 602177" and process is still under environmental entity's analysis. According to Article 17 of resolution 98/2017 issued by State Environmental Council, license is valid until this process ends.

Some of the contributions highlighted by the PDD registered for the first crediting period.

a) Contribution to the local environmental sustainability

[36] Conselho Nacional do Meio Ambiente (Environmental National Council)

The Rondinha SHPP complies with the several environmental rules and rules from the electrical sector, stated either by CONAMA or ANEEL. Regarding this regulation the project has adopted several mitigation actions, such as an environmental education/social communication program, monitoring program of water and sediment levels, monitoring plan of limnology and water quality, conservation programs, recovery program, deforestation program, environmental control program to prevent erosion processes in accesses and internal ways from Rondinha SHPP and a fauna monitoring and conservation monitoring program. (See point D.2)

b) Contribution to the development of working conditions and net job generation

During the construction period of the power plant 300 people employed for a period of 12 months. When the project became fully operational, it generates a permanent employment for 12 people to perform tasks such as operation and maintenance, including maintenance of green areas, cleaning and security. It is worth noting that the project gives to its workers all formal working conditions, including training programs for the workers. On the other hand, the operation of the project, and hence the controlled supply of energy, provides incentives to the increase in productive activities in several economic sectors. It has an impact on the job generation for primary and secondary sectors in the midterm (it makes the energy intensive economic activities more dynamic, such as agro-industrial processes) and for the business and services sector in the mid-long term.

The project is committed to the social responsibility within the region, performing an environmental education program to serve the state and municipal educators, project workers and service providers and the community in general. This shall allow to inform involved parties and also to identify possible needs of local population.

c) Contribution to income distribution

Once operating, the project generates a positive direct impact in the region where it operates, because it provides the population with improvements in its quality of life by having an increased access to energy (at lower costs than importing energy or reinforcing the system) and by showing a tendency to increase the energy supply and the restructuring of the supply in line with the growing demand.

Moreover, as discussed above, the project shall positively affect to the indirect generation of employment, giving more dynamism to several economical sectors. The region also benefited from the taxes generated from the electricity sale, which translates into an improvement of local and regional infrastructure, attending to social demands consequence of the economic dynamism. These factors, besides of contributing to a higher income level can as consequence derive in a better income distribution.

d) Contribution to training and technological development

The development of the project involves training on specialized personnel to operate the small hydroelectric power plant and to correctly manage the project. On the other hand, regarding the technological development, it is worth to note that Brazil has a vast hydroelectric potential and its electrical system relies mainly on hydroelectric plants. Still the region where the project is being developed has access to electricity through the interconnected system and an isolated system, which means that the project indeed transfers technology to the local grid. This case could be easily replicated in order to boost the development of hydroelectric projects in the region.

e) Contribution to the regional integration and articulation with other sectors

As explained earlier the project generates a positive impact in the region due to the increase of employment opportunities and better income distribution. These consequences impact several sectors as mentioned above, supporting then the local and regional economy by boosting the

regional energetic integration, decreasing electrical vulnerability and dependency on fossil fuels (isolated grid).

D.2. Environmental impact assessment

This project has minor environmental impact, because it is considered of small scale according to the Brazilian laws. The project activity has less than 30 MW and also it has a flooded area which is under the threshold of 3 km^2. Despite the small scale of the project, the requirements for obtaining the environmental permits demands some conditions during the construction and the operation. A environmental analysis study called EAS (*Estudo Ambiental Simplificado* or Simplified Environmental Study) was performed. It includes the monitoring of physical/chemical aspects (water and ground quality, erosion) and biological aspects (ichthyic fauna, terrestrial animals and flora). This monitoring process was handled by an external company *Impacto Assessoria Ambiental.*

The plan focused on twelve different areas of analysis detailed below.

1) The removal of vegetation cover occured for two reasons. One, the general implementation of the project required the removal of vegetation. In addition later phases of the project involved vegetation removal from affected areas in order to minimize impacts on water quality and aquatic biota.
2) Some habit loss and increased hunting and fishing could happen in the region. The main concern is the impact such loss could have on riparian and secondary forests. However the expectation is that the losses would be minimal and therefore recovered with time.
3) The erosive process may be accelerated by the construction of roads necessary for the project. This could lead to drainage interruption and damage to surrounding vegetation in the valleys.
4) Water quality could also be affected by population increase associated with the project. The mobilization of manpower would lead to a population increase which could lead to increased discharge of sewage which in turn could result in increased bacterial levels and turbidity.
5) Changes to Icthyofauna may occur with the establishment of cofferdams which would alter the structure and function of biotic flows. However, the loss of biodiversity was expected to be limited by the increase in biomass.
6) The elevation of groundwater could occur however effects were expected to be minimal and any landslides were minor.
7) Waste generation could have a major impact on SHPP levels. This impact would be caused by the supplying and storage of fuel as well as oil changes of machinery and vehicles. These processes therefore need to be well documented and carried out by well trained employees.
8) Population growth was expected to occur due to the generation of jobs and migration to the area during construction phase.
9) Changes in the labor market were expected due to an immediate boost in labour jobs. This could impact the local economy resulting in more investment options and improved living conditions.
10) Traffic was expected to intensify on BR-282 freeway.
11) Changes in the health framework were expected to occur due to the influx of new people who could serve as hosts for new diseases. There was also an increased possibility of work related injury and psychological effects related to the new work environment.
12) Finally a certain degree of community relocation could occur but was expected to be minimal and families had to be taken care of.

Overall effects were expected to be minimal but attention was paid to all areas of concern, especially with regards to waste generation.

Inside of the EAS specific programs was designed and these were the programs established:

- Monitoring and Control Program of Aquatic Ecosystem;

- Monitoring and Control Program of Changes in Land Ecosystem;
- Program to recover degraded áreas;
- Waste Management Program;
- Employee Orientation and capacitation Program;
- Environmental Education and Social Communications;
- Environmental Monitoring Programme.

The project also signed compensation agreements with the relocated population.

SECTION E. Local stakeholder consultation

This section was copied from registered PDD for the first crediting period.

E.1. Modalities for local stakeholder consultation

According to the federal and local state legislation, the environmental licensing process may requests public hearings with the local community. Also, the same legislation requests the announcement of the issuance of the licenses (LP, LI and LO) in the local state official journal (*Diário Oficial do Estado*) and in the regional newspapers.

Other than the stakeholders comments requested for the environmental licenses, the Brazilian Designated National Authority, "*Comissão Interministerial de Mudanças Globais de Clima*", requests, in order to provide the letter of approval, that comments are required to local stakeholders based on a translated version of the PDD, and the validation report is issued by an authorized DOE (according to the Resolution no. 7, issued on March 5th, 2008). The translated version was sent to the stakeholders on October 11th2011, marking the Public Consultation date.

The proponent of the project has sent the PDD to public consultation to the following stakeholders:

- Municipal Council of Passos Maia (Câmara Municipal de Passos Maia);
- Municipality of Passos Maia (Prefeitura de Passos Maia);
- State Economic Sustainable Development Secretary of Santa Catarina (Secretaria Estadual do desenvolvimento económico sustentavel de Santa Catarina);
- Federal Public Ministry (Ministerio Publico Federal)
- Environmental foundation of Santa Catarina (Fundacion do Meio Ambiente de Santa Catarina)
- Santa Catarina Public Ministry (Ministerio Publico de Santa Catarina)

It is to be mentioned that the municipalities of João Câmara and Parazinho have no community association, therefore there was no letter sent for them. Regarding the *Fórum Brasileiro de ONGs e Movimentos Sociais para o Meio Ambiente e o Desenvolvimento* (FBOMS) or Brazilian Forum of NGOs and Social Movements for Environment and Development the PP called the Brazilian DNA for their new address but they didn't have it yet.

E.2. Summary of comments received

One comment was received by the end of this PDD version, from the Municipality of Passos Maia, specifically from the City Council Chamber. The comment is a positive one and acknowledges the procurement of the Installation license, the contribution of the project to the local development in several areas as job creation, development of the commercial and services sectors in the zone and the contribution with the sustainability of the Brazilian electric energy grid.

E.3. Consideration of comments received

The comments received are positive ones and do not expect modifications or clarifications from the project, so there was no issue to take care of.

SECTION F. Approval and authorization

The Party involved in the project activity is Brazil. Letter of approval is available at: https://cdm.unfccc.int/Projects/DB/DNV-CUK1418833982.52/view

Appendix 1. Contact information of project participants

Organization name	Rondinha Energética S.A.
Country	Brazil
Address	603, Dr. Carlos de Carvalho Avenue. 8th Floor. Centro. Curitiba-PR. Zip Code: 80.430-180
Telephone	55 41 3021 1100
Fax	
E-mail	ricardo.aquino@tradener.com.br
Website	www.tradener.com.br
Contact person	Ricardo Aquino

Appendix 2. Affirmation regarding public funding

Not Applicable. No public funding from Parties included in Annex I to the Convention was granted to the project activity.

Appendix 3. Applicability of methodologies and standardized baselines

All information is provided throughout the text.

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

All information is provided throughout the text.

Appendix 5. Further background information on monitoring plan

All information is provided throughout the text.

Appendix 6. Summary report of comments received from local stakeholders

All information is provided throughout the text.

Appendix 7. Summary of post-registration changes

To register the post-registration changes, Project Participants (PPs) had to use the current template of CDM-PDD-FORM. This form has some sections and requirements that were not

present the CDM-PDD-FORM used at the registered PDD. Also, the order of the sections is not the same. Therefore, some updates were necessary to attend it.

The post registration changes proposed in this version of the PDD are:

Permanent Changes to the Project Design

Letter "H" of item 241 of the CDM project standard for project activities:

"Actual operational parameters that are within the control of the project participants, differing from the expected parameters";

1. The turbines implemented by the project activity have different capacity (5.410 MW) from the predicted in the registered PDD (4.990 MW). This change did not impact the installed capacity of the plant and the electricity supply to the grid estimation, which is defined by generators capacity.
2. The registered PDD stated that the generators have 5.333 kVA of installed capacity each, with load factor of 0.9. Using these values, the registered PDD considered the installed capacity of the plant as 9.6 MW which is a rounded value for 9.5994 MW which is obtained if the load factor is applied to the capacity of the generators. The rounded value of 9.6 MW is the official installed capacity value considered by regulators and authorities in Brazil for the plant. All environmental licenses, sectorial authorizations and permits refer to and installed capacity of 9.6 MW. Brazilian Regulators do not consider this immaterial variation a change in the installed capacity. However, to use the exact value of the installed capacity of the plant, as CDM definition, this PDD was updated, using the value of 9.5994 MW as installed capacity of the plant. No additional investment was performed, and these changes do not affect the revenues potential of the plant. Therefore, additionality analysis was not affected.
3. The area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full reservoir area (A_{PJ}) is a parameter to be monitored. The operation license of the plant 3370/2018 showed that the reservoir area implemented differs from information presented at the PDD registered. A_{PJ} of Rondinha SHP is 620,000. This value was also updated in the PDD.
4. Changes of item 2 and 3 impacted power density result which was also updated.

Additionally, to comply paragraph 242 of the CDM project standard for project activities, the PP shall report in the revised PDD the impacts of the proposed or actual changes to the registered CDM project activity on the following:

- **The applicability and application of the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents with which the project activity has been registered;**

There is no impact in the applicability and application of the applied methodologies and the other applied methodological regulatory documents with which the project has been registered.

- **The project boundary and any implications on the inclusion or exclusion of emissions sources and leakage emissions**

There is no impact in the project boundary and any implications on the inclusion or exclusion of emissions sources and leakage emissions.

- **The compliance of the monitoring plan with the applied methodologies, the applied standardized baselines and the other applied methodological regulatory documents;**

There is no impact in the compliance of the monitoring plan with the applied methodologies and the other applied methodological regulatory documents.

- **The level of accuracy and completeness in the monitoring of the project activity compared with the requirements contained in the registered monitoring plan;**

There is no impact in the level of accuracy and completeness in the monitoring of the project activity compared with the requirements contained in the registered monitoring plan.

- **The additionality of the project activity;**

There is no impact in the additionality of the project activity.

- **The scale of the project activity.**

There is no impact in the scale of the project activity which is a large scale project activity.

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Document information

Version	*Date*	*Description*
12.0	8 October 2021	Revision to: Improve consistency with version 03.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN).
11.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.

Version	*Date*	*Description*
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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