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

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

Title of the project activity: Riachão III and V Wind Power Plants CDM Project Activity.

PDD version number: 3.

Date (DD/MM/YYYY): 05/04/2012.

A.2. Description of the project activity:

The primary objective of Riachão III and V Wind Power Plants is to help meet Brazil's rising demand for energy due to economic growth and to improve the supply of electricity, while contributing to environmental, social and economic sustainability by increasing the share of renewable energy in total electricity consumption for Brazil (and for the region of Latin America and the Caribbean).

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

The privatization process of the electric sector initiated in 1995 commenced with the expectation of adequate tariffs, fewer subsidies, and better prices for generators. It drew the attention of investors to possible alternatives not available in the centrally planned electricity market. In the late 1990's a strong increase in demand contrasted with an under average increase in installed capacity caused the outbreak of the supply crisis/rationing in 2001/2002. One of the solutions the government provided was flexible legislation, favoring smaller independent energy producers. Furthermore the possible eligibility under the Clean Development Mechanism of the Kyoto Protocol drew the attention of investors to renewable energy projects.

This cleaner source of electricity also provides an important contribution to environmental sustainability. The project activity reduces emissions of greenhouse gas (GHG) by avoiding electricity

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

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

generation from fossil fuel sources (and CO_2 emissions), which would be generated (and emitted) in the absence of the project.

The project consists of the construction of two wind power projects: Riachão III and Riachão V with 28.8 MW installed capacity each one. Both plants are located in Ceará-Mirim, Rio Grande do Norte State, Northeastern region of Brazil. The project is expected to become fully operational in November 2014[3].

Riachão III and V are owned by Expansão Energia Ltda. Expansão Energia Ltda. is controlled by Atiaia Energia, one of the companies of Cornélio Brennand Group. Atiaia Energia was founded in October 2004, with headquarters in the city of Recife (Pernambuco State) and commercial office and operational basis in Cuiabá (Mato Grosso State).

Prior to the implementation of the project activity no wind power plant was operational in the location where Riachão III and V are being built. The project activity will reduce emissions of GHG by avoiding electricity generation from fossil fuel sources, which would be generated (and emitted) in the absence of the project. In conclusion, the baseline scenario and the scenario without the project activity are the same.

Riachão III and V projects can be seen as a solution by the private sector to the Brazilian electricity since it may help to avoid another electricity supply crisis, contributing to sustainable development and having a positive effect for the country beyond the evident reductions in GHG.

Although the project activity does not have a major impact in the host country given its electric system size, it is part of a greater idea. The project contributes to sustainable development since it meets the present needs without compromising the ability of future generations to meet their own needs, as defined by the Brundtland Commission (1987). In other words, the implementation of wind power plants ensures renewable energy generation, reduces the national electric system demand, avoids negative social and environmental impact caused by the construction of large hydropower plants with large reservoirs and fossil fuel thermo power plants, and drives regional economies, increasing quality of life in local communities.

Therefore, the project has indisputably reduced negative environmental impacts and will developed the regional economies, resulting, consequently, in better quality of life. In other words, environmental sustainability combined with social and economic justice, undeniably contribute to the host country's sustainable development.

A.3. Project participants:

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

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*)	Kindly indicate if the Party involved whishes to be considered as project participant

[3] Specifications of Riachão III and Riachão V presented in "Memorial descritivo Riachão III" and "Memorial descritivo Riachão V" dated January 2012.

	(as applicable)	**(Yes/No)**
Brazil (host)	Atiaia Energia S/A (Private entity)	No
	Ecopart Assessoria em Negócios Empresariais Ltda. (EQAO) (Private entity)	
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Detailed contact information on party(ies) and private/public entities involved in the project activity listed in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil.

A.4.1.2. Region/State/Province etc.:

Rio Grande do Norte State.

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

Ceará-Mirim municipality.

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

The geographic coordinates of the site is presented in the table below.

Table 2 – Project geographic coordinates

Geographic Coordinates	*Riachão III*	*Riachão V*
Longitude (West)	35º 25’ 5’’	35º 26’ 15’’
Latitude (South)	5º 33’ 44’’	5º 33’ 35’’

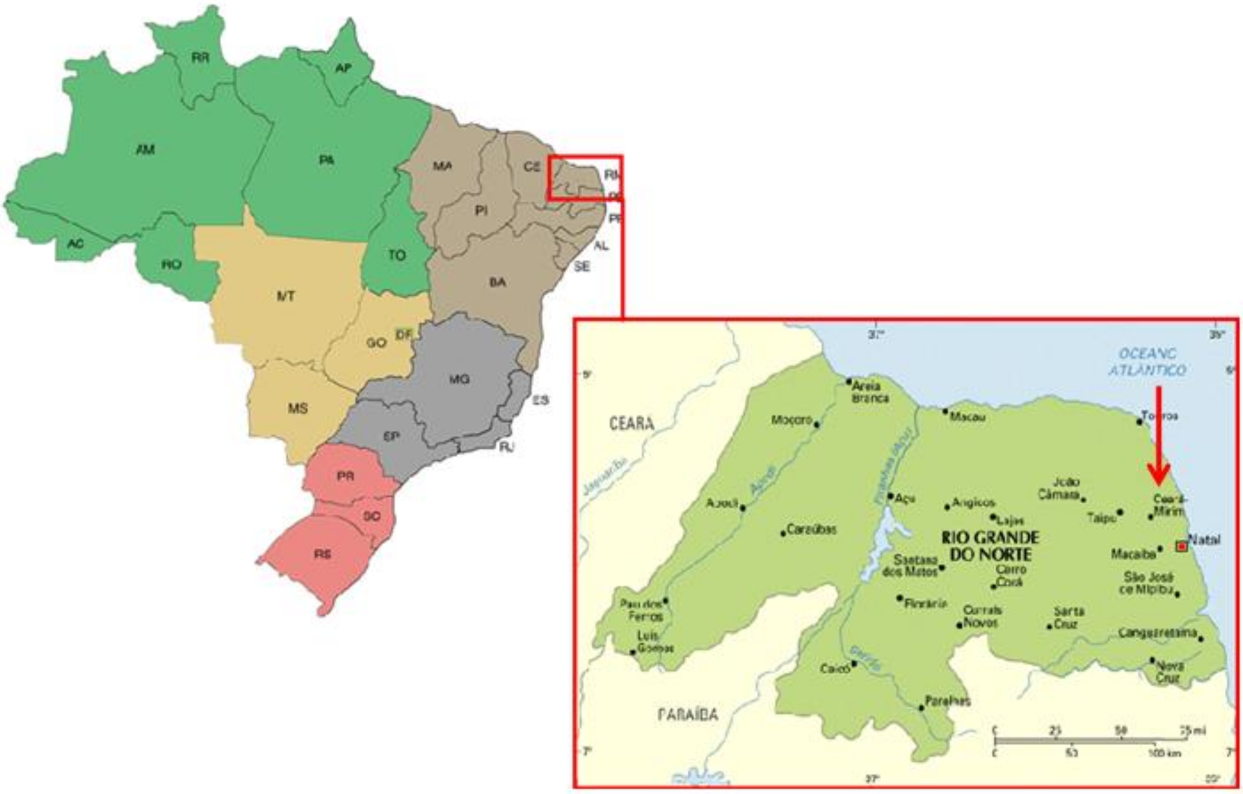

Figure 1 – Rio Grande do Norte State (on the left) and Ceará-Mirim municipality (on the right)

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

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

Category: Renewable electricity generation for a grid.

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

As mentioned earlier on section A.2., in the absence of the project activity all the energy would be supplied by other plants of the interconnected grid. Hence, the baseline scenario is identified as the continuation of the current (previous) situation of electricity. Prior to the implementation of the project activity there was no wind power plant operational in the same location of Riachão III and Richãi V projects. Therefore, the baseline scenario and the scenario without the project activity are the same, and the GHG (CO_2) emissions in the baseline scenario are represented by the emissions from the operational plants connected to the National grid.

In the project activity scenario, wind energy means installing a device which converts part of the kinetic energy in the atmosphere to, say, mechanical useful energy[4]. A wind turbine is a device for extracting kinetic energy from the wind[5]. According to WWEA[6] (2006), wind turbines that generate electricity and feed it directly to the grid usually have two or three rotor blades, while horizontal axis, a nacelle with a rotor hub, gears, and a generator, all of which can be turned into and out of the wind. The rotor is positioned in front of the tower in the direction the wind is blowing (windward as opposed to leeward). The figure below presents the basic components of a modern wind turbine.

1. Foundation: it anchors the turbine to the ground while ensuring its stability. Generally it is made of concrete or steel.
2. Tower: its height varies as a function of the rated power of the turbine as well as its rotor diameter.
3. Nacelle: this component holds the turbine machinery.
4. Rotor blade: the rotor as well as the rotor blades are the equipment which effectively convert the wind energy into rotary mechanical movement
5. Hub: The hub is the center of the rotor to which the rotor blades are attached.
6. Transformer (this is not a part of the Wind Turbine)

Figure 2 – Schematic view of the components of a wind turbine

Source: WWEA, 2006[5]

The purpose of the project activity consists of the construction of two wind power plants summing 57.6 MW of installed capacity. Riachão III and V projects are estimated to have the following technical description[7]:

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[4] SØRENSEN, B. **Renewable Energy.** Academic Press, 2004 - 3rd edition, 928 p. Partially available at <http://books.google.com.br/books?id=Y17FoN2VUEwC&printsec=frontcover#v=onepage&q&f=false> Accessed on 25 April 2011.

[5] BURTON, T.; SHARPE, D.; JENKINS, N.; BOSSANYI, E. **Wind Energy Handbook**, Wiley: 2001, 642 p. Partially available at < http://books.google.com.br/books?id=4UYm893y-34C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false>. Accessed on 25 April 2011.

[6] WWEA – World Wind energy Association. **Wind Energy: Technology and Planning.** 2006. Available at <http://www.wwindea.org/technology/intro/estructura-en.htm>. Accessed on 25 April 2011.

[7] 7 Specifications of Riachão III and Riachão V presented in “Memorial descritivo Riachão III” and “Memorial descritivo Riachão V” dated January 2012 (page 10 of the pdf document).

Table 3 - Technical description of Riachão III and V projects

Wind Power Plants		*Riachão III*	*Riachão V*
General	Model	GE 1.6 - 100	GE 1.6 - 100
	Quantity	18	18
	Nominal Power (kW)	1,600	1,600
	Installed capacity (MW)	28.8	28.8
	Manufacturer	GE Energy	GE Energy
Rotor	Diameter (m)	100	100
	Hight (m)	100	100
	Area swept (m^2)	7,854	7,854
	Nominal revolutions (rpm)	9.75 - 16.18	9.75 - 16.18
	Number of blades	3	3
Operational data	Cut-in wind speed (m/s)	3.0	3.0
	Cut-out wind speed (m/s)	25.0	25.0
	Rated wind speed (m/s)	11.0	11.0

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

Table 4 – Estimated emission reductions of the project activity during the first crediting period

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1 - (2014)*	9,274
Year 2 - (2015)	55,501
Year 3 - (2016)	55,501
Year 4 - (2017)	55,501
Year 5 - (2018)	55,501
Year 6 - (2019)	55,501
Year 7 - (2020)	55,501
Year 8 - (2021)**	46,225
Total estimated reductions (tonnes of CO_2e)	388,505
Total number of crediting years	7
Annual average over the first crediting period of estimated reductions (tonnes of CO_2e)	55,501

*Starting on November 1st

**Until October 30th

A.4.5. Public funding of the project activity:

There is no recourse to any public funding by the Project Participants in the proposed project activity. The project proponents hereby confirm that there is no diversion of Official Development Assistance (ODA) to the proposed project activity.

SECTION B. Application of a baseline and monitoring methodology

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

ACM0002 - "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 12.3.0)[8].

ACM0002 refers to the latest approved versions of the following tools:

- Tool to calculate the emission factor for an electricity system (Version 2.2.1);
- Tool for the demonstration and assessment of additionality (Version 6.0.0);
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 2).
- Combined tool to identify the baseline scenario and demonstrate additionality (version 4.0.0).

In order to assess and demonstrate the additionality of project activities, ACM0002 refers to the "Tool for the demonstration and assessment of additionality" (Additionality Tool) and the "Combined tool to identify the baseline scenario and demonstrate additionality" (Combined Tool). However, the Combined Tool is not applicable for Greenfield facilities where the output could be provided by other existing facilities, which is the case of the proposed project activity[9]. Therefore, the Additionality Tool was used to demonstrate and assess the project additionality.

Furthermore, since there are no GHG emissions involved in the project activity scenario, the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" was not applied in the proposed project activity.

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

The methodology ACM0002 is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

Riachão III and Riachão V are new grid-connected power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plants), i.e. option (a) above.

Furthermore, the methodology is applicable under the following conditions:

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[8] Available at: <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>.

[9] Information presented in footnote 4 of the "Combined tool to identify the baseline scenario and demonstrate additionality".

- The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.

  Riachão III and Riachão V are new wind power plants connected to the Brazilian Interconnected System ("SIN" from the Portuguese Sistema Interligado Nacional).

- In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected)*:* the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;

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

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

  Not applicable. The proposed project activity does not correspond to a hydropower plant.

- In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 after the implementation of the project activity all of the following conditions must apply:
  - The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2;
  - All reservoirs and hydropower plants are located at the same river and where are designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant;
  - The water flow between the multiple reservoirs is not used any other hydropower unit which is not a part of the project activity

- The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4 W/m^2, is lower than 15 MW;
- The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.

Not applicable. The proposed project activity does not correspond to a hydropower plant.

Furthermore, the project activity does not involve:

- Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;
- Biomass fired power plants;
- Hydropower plant that result in new single reservoir or in the increase in existing single reservoir where the power density of the reservoir power plant is less than 4 W/m^2;
- Retrofits, replacements, or capacity additions.

ACM0002 is still applicable for the proposed project activity since it does not correspond to any of the restrictions listed above.

In summary, Riachão III and Riachão V are new wind power plants connected to the Brazilian Interconnected System and, therefore, ACM0002 is applicable to the proposed project activity.

The project activity also complies with all the applicability conditions presented in the tools mentioned in section B.1. as can be checked and confirmed by analyzing the following sections.

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

According to ACM0002, *the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to*.

On May 26th, 2008, the Brazilian Designated Authority published Resolution #8[10] defining the Brazilian Interconnected Grid as a single system covering all five geographical regions of the country (North, Northeast, South, Southeast and Midwest).

The figure below is a representation of the project boundary.

[10] Comissão Interministerial de Mudança Global do Clima (CIMGC). Available at: <http://www.mct.gov.br/upd_blob/0024/24719.pdf>.

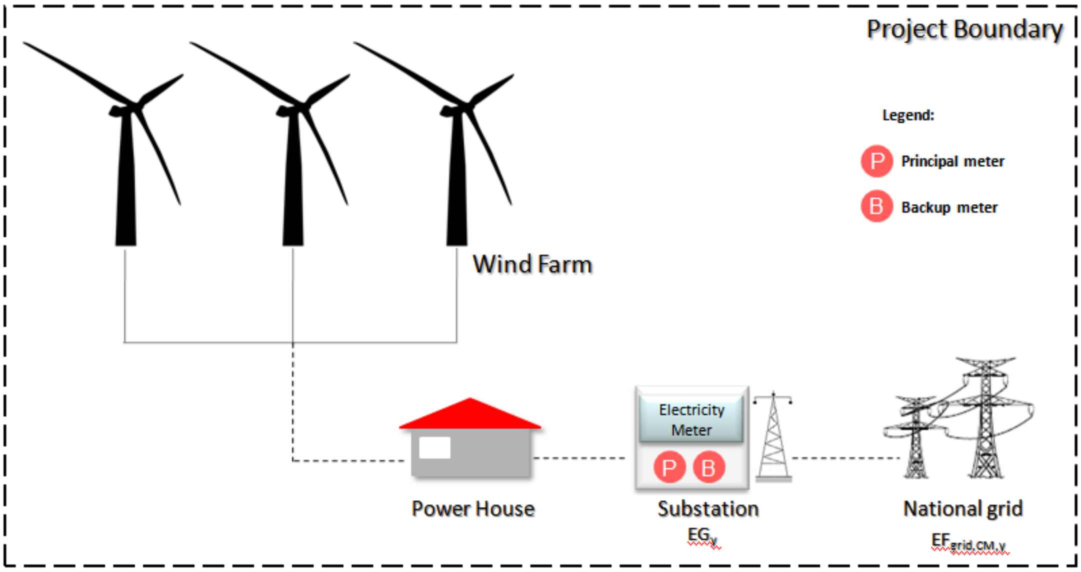

Figure 3 - Project boundary

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

Table 5 - Emissions sources included or excluded in the project boundary

	Source	Gas	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 geothermal power plants, fugitive emissions of CH_4 and CO_2 from noncondensable gases contained in geothermal steam.	Not applicable.		
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	Not applicable.		
	For hydro power plants, emissions of CH_4 from the reservoir.	Not applicable.		

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

The project activity does not modify or retrofit any existing electricity generation facility. Hence, accordingly to ACM0002 the baseline scenario is the following:

"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations as described in the "Tool to calculate the emission factor for an electricity system".

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

(i) Definition of the project starting date

The CDM glossary of terms defines the starting date of a non A/R project activity as "*the earliest date at which either the implementation or construction or real action of a project activity begins*". Considering this definition, the 41st CDM EB Meeting Report[11] clarified that:

"*the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. This, for example, can be the date on which contracts have been signed for equipment or construction/operation services required for the project activity. Minor pre-project expenses, e.g. the contracting of services /payment of fees for feasibility studies or preliminary surveys, should not be considered in the determination of the start date as they do not necessarily indicate the commencement of implementation of the project*".

The only expense incurred for the project implementation is related to the issuance of the Preliminary License (from the Portuguese *Licença Prévia – LP*):

Table 6 – Description of the Riachão III and V Preliminary Licenses

Preliminary License	*Number*	*Date of issuance*
Riachão III	2010- 036863/TEC/LP- 0077	14/05/2010
Riachão V	2010- 036866/TEC/LP- 0079	22/04/2010

However, the issuance of the Preliminary License cannot be considered as the project starting date since the LP issuance is classified as minor pre-project expenses. Undoubtedly, the project sponsor can sell Riachão III and Riachão V projects if legal/regulatory aspects are not favourable for the project implementation and the CDM revenues are considered unfeasible. In reality, this is not uncommon and a project is purchased more than once.

[11] The 41st CDM EB Meeting Report was held on July 30th to August 2nd, 2008. See Meeting Report available at the UNFCCC's website: <http://cdm.unfccc.int/>.

Since the "real action" for Riachão III and Riachão V did not happen and, thus, the Project Participants considered the project starting date as the estimated date when the Engineering, Procurement and Construction (EPC) contract will be signed, *i.e.* October 30th, 2013[12].

(ii) Demonstration of the prior consideration of the CDM

The "Guidelines on the demonstration and assessment of prior consideration of the CDM" defines "existing project activities" as:

> "*Proposed project activities with a starting date on or after 02 August 2008, the project participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date and shall contain the precise geographical location and a brief description of the proposed project activity, using the standardized form F-CDM-Prior Consideration. Such notification is not necessary if a PDD has been published for global stakeholder consultation or a new methodology proposed to the Executive Board for the specific project before the project activity start date".*

From the clarification above and that the Global Stakeholder Process (GSP) of the project activity is expected to occur before the project starting date, the form F-CDM-Prior Consideration would not need to be sent. However, Project Participants informed the Brazilian DNA ("CIMGC" from the Portuguese *Comissão Interministerial de Mudança Global do Clima*) and the UNFCCC Secretariat on August 16th, 2011 for conservativeness reasons.

(iii) Fulfillment of the requirements presented in the "Tool for the demonstration and assessment of additionality"

For the demonstration of additionality, the proposed baseline methodology refers to the Additionality Tool approved by the Executive Board. The tool considers some important steps necessary to determine whether the project activity is additional and to demonstrate how the emission reductions would not occur in the absence of Riachão III and Riachão V projects. The application of the above mentioned tool is described in the next paragraphs.

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

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

Scenario 1: The alternative to the project activity is the continuation of the current (previous) situation of electricity supplied by the existing power plants from the interconnected system.

Scenario 2: The proposed project activity undertaken without being registered as a CDM project activity.

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[12] Project description of Riachão III and Riachão V presented in "Memorial descritivo Riachão III" and "Memorial descritivo Riachão V" dated January 2012 (page 21 of the pdf document).

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

Both alternatives, the project activity and the alternative scenario, are in compliance with all regulations according the following entities:

- The National Electric System Operator (“ONS” from the Portuguese *Operador Nacional do Sistema Elétrico*);
- The Electricity Regulatory Agency (“ANEEL” from the Portuguese *Agência Nacional de Energia Elétrica*);
- The Mines and Energy Ministry (“MME” from the Portuguese *Ministério de Minas e Energia*);
- The Chamber of Electrical Energy Commercialization (“CCEE” from the Portuguese *Câmara de Comercialização de Energia Elétrica*);
- The Rio Grande do Norte Environmental Agency (“IDEMA” from the Portuguese *Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte*);
- The CDM Executive Board.

SATISFIED/PASS – Proceed to Step 2

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

The additionality of Riachão III and Riachão V projects is demonstrated through an investment benchmark analysis (option III). Options I and II are not applicable since:

Option I – Both the project activity and the alternatives identified in Step 1 generate financial and economic benefits other than CDM related income.

Option II – The implementation of other project types of renewable energy generation - *i.e.* cogeneration or wind farm projects - is not potential alternatives in the site where the project is planned.

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

The financial indicator identified for the project is the project Internal Rate of Return (IRR). The IRR will be compared to the appropriate benchmark of the electric sector (in accordance with paragraph 12, Annex 5, EB62), which is the Weighted Average Cost of Capital (WACC).

Weighted Average Cost of Capital (WACC)

The weighted-average cost of capital (WACC) is a rate used to discount business cash flows and takes into consideration the cost of debt and the cost of equity of a typical investor in the sector of the project activity. The benchmark can be applied to the cash flow of the project as a discount rate when calculating the net present value (NPV) of the same, or simply by comparing its value to the internal rate of return (IRR) of the project. The WACC considers that shareholders expect compensation towards the projected risk of investing resources in a specific sector or industry in a particular country.

The WACC calculation is based on parameters that are standard in the market, considers the specific characteristics of the project type, and is not linked to the subjective profitability expectation or risk profile of this particular project developer. Once a wind power potential is discovered, any corporate entity is able to obtain the authorization from the government to build a wind power plant. In addition to that, even after the project proponent obtains such authorization, it can be negotiated/sold afterwards. Therefore, the use a sectoral benchmark is applicable as per the guidance provided in paragraph 13, Annex 5, EB62.

The WACC presented here was calculated based on December 2011 data and was calculated through the formula below:

WACC = Wd x Kd + We x Ke, where:

We and **Wd** are, respectively, the weights of equity and debt typically observed at the sector. The weights shall be derived from the "Guidelines on the assessment of investment analysis"[13], which considers a default value for CDM projects. **Kd** and **Ke** are, respectively, the cost of debt and cost of equity. Detailed explanations related to both calculations are presented below.

→ *Cost of Debt (Kd)*

Kd is the cost of debt, which is observed in the market related to the project activity, and which already accounts for the tax benefits of contracting debts. **Kd** also derives from long term loans applied to the sector in Brazil, and therefore is based on three variables, including the BNDES financing endeavour credit line's interest rates. Kd is calculated considering the sum of:

- Financial cost (**a**);
- BNDES remuneration (**b**);
- Credit risk rate (**c**).

The financial cost (**a**) is represented by the Long Term Interest Rate ("TJLP" from the Portuguese *Taxa de Juros a Longo Prazo*). TJLP is a variable market figure which assesses the rate of debt to apply to the average party borrowing from BNDES. This figure is the underlying majority found in the debt portion of borrowers from the BNDES. The TJLP is based on factors pertaining to market rates and spread of corporate rates over government risk.

[13] Paragraph 18, EB 62, Annex 5. Available at: <http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf>.

The BNDES remuneration (**b**) and the credit risk rate (**c**) are two other factors that compose the rate of debt companies in Brazil encounter via BNDES. The BNDES remuneration is the fee attached by BNDES for its administrative and operational costs, and for its remuneration. This rate varies according to BNDES policies and is non-negotiable and the least arguable rate in the equation. Regarding the credit risk rate, each year BNDES provides the lower and upper limits of the variation margin of that rate. It respects its perception of the risks, and the bank policies. For the purposes of our calculation and due to the fact that the industry as a whole is being considered, we estimate that rate by averaging the upper limit of the margin with the rate established for loans to direct public administration of States and Cities, which is the lowest rate that could be provided to a private investor.

Two other components for the **Kd** calculation are the marginal tax rate (**t**) and inflation forecast (π). In the **Kd** calculation, the marginal tax rate (**t**) is multiplied by the Cost of debt and then by the debt to total cost of capital ratio to ascertain the debt portion of the WACC formula. In the case of Brazil, and specifically to energy projects, this tax factor could either be 34% or 0%. This is decided by the specific type of project and tax regime under which it sits. In the case of Riachão III and V, **t** = 0% since the tax regime used by project sponsor is the presumed profit (from the Portuguese *Lucro Presumido*).

For the Presumed Profit eligibility, corporate entities revenues must be under Forty eight million Reais per year (Article #13, Law #9.718/1998)[14].

For the Presumed Profit system, 8% of gross sales in addition to financial revenues/earnings is used as basis for the income tax calculation. To this figure a 25% rate is applied resulting in the final income tax value. For the social contribution calculation 12% of gross sales in addition to financial revenues/earnings is used as a basis for the calculation. To this figure a 9% rate is applied resulting in the final social contribution value (As per Article #518 of the Federal Decree #3000, dated 26 March 1999)[15].

Table 7 - – Income Tax and Social Contribution (illustrative calculation)

Income Tax	**$**
Gross Sales	1.000
Presumed Profit for income tax (8%)	80
Financial revenue	500
Total Presumed for income tax	580
Income tax due (app. 25%)	145

Social contribution	**$**
Gross Sales	1.000
Presumed Profit for social contribution (12%)	120
Financial revenue	500
Total Presumed Profit for social contribution	620
Social contribution due (9%)	55.80

[14] Publicly available information in Portuguese at: <http://www.receita.fazenda.gov.br/legislacao/leis/Ant2001/lei971898.htm>.

[15] Publicly available information in Portuguese at: <http://www.receita.fazenda.gov.br/legislacao/leis/L2Parte3.htm>.

Source: KPMG. "Investment in Brazil: tax." (2008)[16]

Therefore, a corporate entity that opts for the presumed profit scheme pays the same rate of income tax and social contribution regardless of its costs, expenses, other cash items such as payable interest and non-cash items such as depreciation, because these elements are not deductable under this system. In this sense, the depreciation and, consequently, the fair value are not considered in the spreadsheet (paragraphs 4 and 5 of Annex 5, EB62).

The nominal rate achieved for debt is used to calculate nominal WACC, which is used to discount nominal cash flow projections. In order to achieve the real cash flow rate, the inflation targeting figure (π) for Brazil is reduced from the nominal figure achieved. The π is obtained from the Brazilian Central Bank (www.bcb.gov.br) and has experienced very little variance in the past 5 years.

Considering explanations above, **Kd** is calculated through the following equation:

$$\mathbf{Kd = [1 + (a + b + c) \times (1 - t)] / [(1 + \pi) - 1]}$$

Table 8 – Cost of Debt (Kd) calculation

Cost of Debt (Kd)	
(a) Financial cost[17]	6.53%
(b) BNDES spread[18]	0.90%
(c) Credit risk rate[19]	2.00%
(a+b+c) Pre-Cost of Debt	9.43%
(t) Marginal tax rate[20]	0.00%
(π) Inflation forecast[21]	4.50%
After tax Cost of Debt	4.71% p.a.

[16] KPMG. Investment in Brazil: tax. São Paulo: Escrituras Editora, 2008. Publicly available in English at http://www.kpmg.com.br/publicacoes/livros_tecnicos/Investment_in_Brazil10_out08.pdf

[17] 5-year average of the Long term Interest Rate (from the Portuguese *Taxa de Juros de Longo Prazo – TJLP*). Available at BNDES' website: <http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Custos_Financeiros/Taxa_de_Juros_de_Longo_Prazo_TJLP/index.html>.

[18] BNDES' remuneration. BNDES' policies. Available at <http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/meio_ambiente.html>.

[19] Credit risk rate. BNDES' policies. Available at <http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Produtos/FINEM/meio_ambiente.html>.

[20] Taxes calculated based on an assumed percentage over the gross revenue.

[21] Central Bank of Brazil. Brazilian inflation targeting. Available at: <http://www.bcb.gov.br/pec/metas/InflationTargetingTable.pdf>

Each data used to calculate **Kd** will be presented to the DOE. The spreadsheet used for WACC calculation will be available with the Project Participants and will be provided to the DOE.

→ *Cost of Equity (Ke)*

Ke represents the rate of return for equity investments and is a summation of the following parameters:

- Risk-free rate (**Rf**);
- Equity risk premium (**Rm**);
- Estimated country risk premium (**Rc**);
- Sectorial risk (**β**)

Rf stands for the risk free rate. The risk-free rate used for **Ke** calculation was a long term bond rate. This bond was issued by the Brazilian government, denominated in US dollars. Therefore the rate includes the Brazilian country risk. There is a higher risk associated to investing in Brazil, or in Brazilian bonds, compared to investing in a mature market such as the United States. This risk is reflected in higher returns expected on Brazilian government bonds compared to the mature markets government bonds. In considering the Brazilian government bond, this premium for a higher risk is captured in our calculations.

In order to adjust the risk-free rate (**Rf**) to the inflation adjusted rate, the expected inflation rate (for the United States) (π**'**) is reduced. The inflation is calculated based on the Consumer Price Index (CPI), from the U.S. Bureau of Labor Statistics, and it is calculated as the annual average change of the index. There is no need to adjust for Brazil's expected inflation when dealing with a hurdle rate in real terms.

Sectorial risk stands for the average sensitivity of comparable companies in that industry to movements in the underlying market. The parameter considered for Sectorial Risk is the beta "**β**" derived from the correlation between returns of US companies from the sector and the performance of the returns of the US market. **β** has been adjusted to the leverage of Brazilian companies in the sector, reflecting both structural and financial risks. **β** adjusts the market premium to the sector.

Rm represents the market premium, or higher return, expected by market participants in light of historical spreads attained from investing in equities versus risk free assets such as government bond rates, investors require a higher return when investing in private companies. The market premium is estimated based on the historical difference between the S&P 500 returns and the long term US bonds returns. The spread over the risk-free rate is the average of the difference between those returns.

Note that in the formula above the factor EMBI+ (Emerging Markets Bond Index Plus), considers as the country risk premium, **Rc**. This factor accounts for the country or sovereign risk embedded in the debt of a country. Assuming that relative to the US risk-free debt market EMBI+ is 0, then Brazil's EMBI+ would calculate for the added or reduced risk relative of Brazils debt markets to the US.

Justification for the EMBI+ addition to the risk-free rate lies in the vast differences between the United States in such factors as credit risk, inflation history, politics, debt markets, and more. Ignoring these differences would result in the incorrect application of relevant environmental factors in the decision-making process of an investor in Brazil.

As mentioned in the **Kd** calculation, in order to achieve the real cash flow rate, the inflation targeting figure (π) for Brazil is reduced from the nominal figure achieved from the Brazilian Central Bank.

Considering explanation above, Ke is calculated through the following equation:

$$\mathbf{Ke = [(1 + Rf) / (1 + \pi') - 1] + (\beta \times Rm) + Rc}$$

Table 9 – Cost of Equity (Ke) calculation

Cost of Equity	
(Rf) Risk-free rate[22]	4.25%
(π') US expected inflation[23]	1.60%
(Rm) Equity Risk Premium[24]	6.03%
(β) Sectorial risk[25]	1.55%
(Rc) Estimated Country Risk Premium[26]	2.45%
Cost of Equity with Brazilian Country Risk	14.44% p.a.

Each data used to calculate **Ke** will be presented to the DOE. The spreadsheet used for WACC calculation will be available with the Project Participants and will be provided to the DOE.

Considering the values presented above, we have the following:

$$WACC = 50\% \times 4.71\% + 50\% \times 14.44\%$$

$$WACC = 9.57\%$$

Internal Rate of Return (IRR)

[22] 30-year US Treasury Yield. Available at Damodaran's website: <http://pages.stern.nyu.edu/~adamodar/>.

[23] Change Average 2010. U.S. Bureau of Labor Statistics. Available at: < ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt>.

[24] Historical S&P500 premium over 10-year US-Treasury Bond. Available at Damodaran's website: <http://pages.stern.nyu.edu/~adamodar/>.

[25] Market weighted average Beta US power Co. re-levered to Brazilian leverage. Available at Damodaran's website: <http://pages.stern.nyu.edu/~adamodar/>.

[26] Emerging Markets Bond Index Plus Brazil. Index calculated by JPMorgan. Available at IPEA's website: < www.ipeadata.gov.br>.

As mentioned above, the financial indicator identified for Riachão III and Riachão V is the project Internal Rate of Return (IRR). The cash flows of both projects present the following IRRs:

Project	***IRR (%)***
Riachão III	6.87
Riachão V	7.32

Table 10– Main parameters of the cash flow

Parameters		**Justification/source of information used**
Riachão III	**Riachão V**	
Installed Capacity		Specifications of Riachão III and Riachão V presented in "Memorial descritivo Riachão III" and "Memorial descritivo Riachão V" dated January 2012 (page 3) and Wind Certification issued by GL Garrad Hassan Ibérica S. L. U. and dated November 14th, 2011 (pages 119 and 120).
28.8 MW	*28.8 MW*	
Plant Load Factor (PLF)		Wind Certification issued by GL Garrad Hassan Ibérica S. L. U. and dated November 14th, 2011 (pages 119 and 120). Therefore, the proposed project activity applies option (b) of the "Guidelines for the reporting and validation of plant load factors", *i.e. "the plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)".*
47.6%	*49.1%*	
Energy price		The Chamber of Electrical Energy Commercialization ("CCEE" from the Portuguese *Câmara de Comercialização de Energia Elétrica*). Results of energy auctions conducted by the Brazilian government in 2011 for wind power projects adjusted based on the inflation targeting for the start-up of the project. Results of the energy auction available at the CCEE's website: <http://www.ccee.org.br/>. Brazilian inflation targeting published in Resolution nr. 3,880 dated June 22nd, 2010 issued by the Brazilian Central Bank (from the Portuguese *Banco Central do Brasil*). Information available at: <http://www.bcb.gov.br/>
113.52 R$/MWh	*113.52 R$/MWh*	
100% TUST or TUSD fee		In each power project, the Tariff for the Use of the Transmission System ("TUST" from the Portuguese *Tarifa de Uso do Sistema de Transmissão*) or the Tariff for the Use of the Distribution System ("TUSD" from the Portuguese *Tarifa de Uso do Sistema de Distribuição*) fee must be applied in Brazil. The choice of TUSD or
BRL 3.35/kW/month	*BRL 3.35/kW/month*	

		TUST fee depends if the power plant is directly or indirectly connected to the electricity connection network (in a free translation from the Portuguese *rede básica de conexão*). However, independently if the project is directly or indirectly connected to the electricity connection network, the fee shall be paid. Electricity producers using renewable sources receive a 50% discount in the TUST and TUSD fee. This discount aims at boosting investments in renewable energy projects and shall be considered as a Type E- policy as defined by Annex 3, EB 22. Additionally, according to this clarification, type E- policies[27] do not need to be considered in the development of the baseline scenario if implemented after 11 November 2001. The reduction in the TUST/TUSD fee was established by ANEEL Resolution nr. 77 dated 18/08/2004[28]. Therefore, the discount was not taken into account. The value used in the IRR calculation is based on ANEEL Resolution nr. 1,139 dated April 19th, 2011.
Investment (R$/MW)		Based on quotations from the manufacturer. GE Energy quotation dated June 2011 (pages 2 and 4).
3,189,781	*3,189,781*	

Project cash flow is available with the Project Participants and was presented to the DOE.

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

Riachão III and Riachão V cash flows demonstrate that both IRRs are lower than WACC (9.57%). This demonstrates that the project activity is not financially attractive to investor:

Sub-step 2d. Sensitivity analysis

As required by the Additionality Tool, a sensitivity analysis was conducted to demonstrate whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. Therefore, the sensitivity analysis of the project was conducted by altering the following parameters:

- Increase in project revenues (energy price and plant load factor/energy assured);

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[27] From paragraph 6.b) of Annex 3, EB 22 Type E- policies are *National and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs).*

[28] Available in Portuguese at <http://www.aneel.gov.br/cedoc/ren2004077.pdf>. Accessed on 02/09/2011.

- Reduction in running costs (operation costs and investments).

According to the Guidelines on the Assessment of Investment Analysis "*only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation*". In addition, it states that "*variations in the sensitivity analysis should at least cover a range of +10% and -10%*". Therefore, financial analysis shall be performed based on the criteria established above.

Table 11 – Sensitivity analysis 1 (-/+10% variation)

Scenario	***% change***	***IRR (%)***	
		Riachão III	***Riachão V***
Original	-	6.87	7.32
Increase in the energy price	10%	8.25	8.71
Increase in the project plant load factor (PLF)/energy assured		8.25	8.71
Reduction in project costs		7.25	7.69
Reduction in project investment		8.10	8.57

It is important to note that the average of the Brazilian inflation in 2010 was of 5.91% and in 2011 was equal to 6.5%[29]. The use of 10% of variation, around two times the 2010 and 2011 inflation rate, in the variation of costs and revenues of the project activity was chosen as a very conservative approach.

Furthermore, according to the "Guidelines on the assessment of investment analysis", whenever a scenario results in an IRR higher than the benchmark, an assessment on the probability of the respective occurrence shall be presented. Although none of the scenarios presented above the IRR reaches or surpasses the benchmark, the Project Participants also conducted the sensitivity analysis by altering each parameter until the IRR reaches the benchmark (9.57%) and analyzed the probability of the occurrence of these scenarios. Results of this sensitivity analysis are presented in the table below:

Table 12 – Sensitivity analysis 2 (variation in the parameters until the IRR reaches the benchmark)

Scenario	***Riachão III***	***Riachão V***
	% change	
(a) Increase in the energy price	+20%	+16%

[29] The IPCA is used as a parameter for the inflation targeting system. In 2011 IPCA's accumulated growth was equal to 6.5%. This index is published by several institutions in the country. One of these institutions is the Institute for Applied Economic Research ("IPEA" from the Portuguese *Instituto de Pesquisa Econômica Aplicada*) available at < http://www.ipeadata.gov.br/>.

(b) Increase in the project plant load factor (PLF)/energy assured	+20%	+16%
(c) Reduction in operational costs	-78%	-64%
(d) Reduction in project investment	-20%	-17%

The probability of the occurrence of these scenarios is presented below:

(a) Increase in the energy price

The energy price considered in the project cash flow is based on the energy auctions conducted by the Brazilian government in 2011 for wind power projects adjusted to the expected date of the operation starting of the project.

As presented in the table above, a 20% increase in the energy price in the case of Riachão III and 16% in the case of Riachão V would be required to the IRR reaches the benchmark. Therefore, the energy price would be BRL 135.78/MWh for Riachão III and BRL 131.94/MWh for Riachão V. However, the results of the latest energy auctions demonstrate the tendency of the decrease in the energy price. Results of the energy auctions from 2009 to 2011 conducted by the Brazilian government can be seen in the following link: <http://www.ccee.org.br/> and are presented in tables below.

Table 13 – Results of the energy price for wind power projects - auction of December 14th, 2009

Project	*Installed capacity (MW)*	*Assured energy (MW-ave)*	*Contracted energy (energy lots)*	*Energy price (BRL /MWh)*
ARATUA 1	14.40	6.90	6	151.77
AREIA BRANCA	27.30	11.70	11	152.63
ARARAS	30.00	12.60	12	150.38
BURITI	30.00	11.00	11	150.38
CAJUCOCO	30.00	12.00	12	150.38
COQUEIROS	27.00	11.60	11	150.38
QUIXABA	25.20	9.00	9	153.05
GARCAS	30.00	13.20	13	150.38
LAGOA SECA	19.50	8.10	8	152.18
MIASSABA 3	50.40	22.80	22	152.07
PEDRA DO REINO	30.00	10.80	10	152.27
VENTO DO OESTE	19.50	7.80	7	152.18
COXILHA NEGRA V	30.00	11.30	11	131.00
COXILHA NEGRA VI	30.00	11.30	11	131.00
COXILHA NEGRA VII	30.00	11.30	11	131.00
MORRO DOS	28.80	13.50	13	151.04

VENTOS I				
MORRO DOS VENTOS III	28.80	13.90	13	151.01
MORRO DOS VENTOS IV	28.80	13.70	13	151.02
MORRO DOS VENTOS IX	28.80	14.30	14	151.03
MORRO DOS VENTOS VI	28.80	13.10	13	151.05
MACAUBAS	30.00	13.40	13	139.99
NOVO HORIZONTE	30.00	10.90	10	139.99
SEABRA	30.00	11.30	11	139.99
DUNAS DE PARACURU	42.00	19.70	19	149.96
FAZENDA ROSARIO	8.00	3.20	3	146.00
FAZENDA ROSARIO 3	14.00	5.50	5	146.00
OSORIO 2	24.00	9.20	9	149.99
SANGRADOURO 2	26.00	9.90	9	149.99
SANGRADOURO 3	24.00	9.20	9	149.99
EMBUACA	25.20	11.10	11	151.07
BARRA DOS COQUEIROS	30.00	10.50	10	152.50
COLONIA	18.90	8.20	8	149.90
ICARAI I	27.30	13.00	13	142.00
ICARAI II	37.80	18.00	18	142.00
TAIBA AGUIA	23.10	10.60	10	149.90
TAIBA ANDORINHA	14.70	6.50	6	149.90
REI DOS VENTOS 1	48.60	21.80	21	152.77
REI DOS VENTOS 3	48.60	21.00	21	153.07
EURUS VI	7.20	3.10	3	150.00
FAISA I	25.20	9.30	9	152.66
FAISA II	25.20	9.50	9	152.65
FAISA III	25.20	8.30	8	152.69
FAISA IV	25.20	8.50	8	152.67
FAISA V	27.30	9.00	9	152.68
CABECO PRETO	19.80	6.50	6	151.97
USINA DE MANGUE SECO 1	25.20	12.30	12	149.99
USINA DE MANGUE SECO 2	25.20	12.00	12	149.99
USINA DE MANGUE SECO 3	25.20	12.70	12	149.99

USINA DE MANGUE SECO 5	25.20	13.10	13	149.99
MAR E TERRA	23.10	8.30	8	152.64
ICARAI	14.40	7.80	7	151.08
ALVORADA	7.50	3.90	3	144.94
CANDIBA	9.00	4.20	4	144.94
GUANAMBI	16.50	8.40	8	144.94
GUIRAPA	27.00	13.60	13	144.94
IGAPORA	30.00	13.90	13	146.94
ILHEUS	10.50	5.00	5	146.94
LICINIO DE ALMEIDA	22.50	10.90	10	144.94
NOSSA SENHORA CONCEICAO	24.00	12.40	12	146.94
PAJEU DO VENTO	24.00	11.80	11	146.94
PINDAI	22.50	11.00	11	144.94
PLANALTINA	25.50	12.20	12	146.94
PORTO SEGURO	6.00	2.70	2	146.94
RIO VERDE	30.00	16.60	16	144.94
SERRA DO SALTO	15.00	7.40	7	144.94
SANTA CLARA I	28.80	13.70	13	150.00
SANTA CLARA II CPFL	28.80	12.70	12	150.00
SANTA CLARA III	28.80	12.50	12	150.00
SANTA CLARA IV	28.80	12.30	12	150.00
SANTA CLARA V	28.80	12.40	12	150.00
SANTA CLARA VI	28.80	12.20	12	150.00
		Average in BRL/MWh --->		**148.33**

Table 14 – Results of the energy price for wind power projects - auction of August 25-26th, 2010

Project	*Installed capacity (MW)*	*Assured energy (MW-ave)*	*Contracted energy (energy lots)*	*Energy price (BRL /MWh)*
CAMPO DOS VENTOS II	30.0	15.0	140	126.19
PEDRA DO REINO III	18.0	6.8	68	123.98
FAZENDA ROSARIO 2	20.0	8.0	79	125.65
EURUS I	30.0	15.5	145	124.24
EURUS II	30.0	15.2	152	121.83
EURUS III	30.0	16.1	150	124.23
CABECO PRETO IV	19.8	8.4	84	124.45

SERRA DE SANTANA I	19.8	9.7	81	124.75
SERRA DE SANTANA II	28.8	13.5	135	125.15
SERRA DE SANTANA III	28.8	12.7	127	124.85
CRISTAL	30.0	15.7	150	120.93
PRIMAVERA	30.0	16.4	158	120.92
SAO JUDAS	30.0	15.6	152	120.94
RENASCENCA V	30.0	15.0	150	121.83
DA PRATA	19.5	10.1	101	121.25
DOS ARACAS	30.0	15.5	139	121.25
MORRAO	30.0	16.1	147	121.25
SERAIMA	30.0	17.5	153	121.25
TANQUE	24.0	13.9	139	121.25
VENTOS DO NORDESTE	19.5	10.1	101	121.25
		Average in BRL/MWh --->		**122.87**

Table 15 – Results of the energy price for wind power projects - auction of August 26th, 2010

Project	*Installed capacity (MW)*	*Assured energy (MW-ave)*	*Contracted energy (energy lots)*	*Energy price (BRL /MWh)*
ARATUA 3	28.8	11.2	112	137.77
ASA BRANCA I	30.0	13.2	132	135.40
ASA BRANCA II	30.0	12.8	128	135.40
ASA BRANCA III	30.0	12.5	125	135.40
ASA BRANCA IV	30.0	14	140	133.00
ASA BRANCA V	30.0	13.7	136	133.00
ASA BRANCA VI	30.0	14.4	144	133.00
ASA BRANCA VII	30.0	14.3	143	133.00
ASA BRANCA VIII	30.0	13.6	135	133.00
PEDRA BRANCA	28.8	12.2	122	132.50
SAO PEDRO DO LAGO	28.8	13.5	132	132.50
SETE GAMELEIRAS	28.8	12.6	125	132.50
COSTA BRANCA	20.7	9.8	98	130.43
CASA NOVA	180.0	61.4	614	131.50
ATLÂNTICA I	30.0	13.1	131	135.00
ATLÂNTICA II	30.0	12.9	129	135.00
ATLÂNTICA IV	30.0	13	130	135.00
ATLÂNTICA V	30.0	13.7	137	135.00

DREEN BOA VISTA	12.6	6.3	57	137.99
DREEN OLHO DAGUA	30.0	15.3	149	133.97
DREEN SAO BENTO DO NORTE	30.0	14.6	140	133.97
FAROL	19.8	10.1	91	133.97
OSORIO 3	26.0	10.5	103	137.79
EURUS IV	30.0	13.7	137	135.40
ARIZONA 1	28.0	12.9	123	134.59
CAETITE 2	30.0	11.2	110	137.99
CAETITE 3	30.0	11.2	111	137.99
CALANGO 1	30.0	13.9	138	132.80
CALANGO 2	30.0	11.9	118	132.80
CALANGO 3	30.0	13.9	138	132.80
CALANGO 4	30.0	12.8	128	132.80
CALANGO 5	30.0	13.7	136	132.80
MEL 02	20.0	9.8	93	132.80
JUREMAS	16.1	7.6	75	136.01
MACACOS	20.7	9.8	97	136.01
VENTOS DO MORRO DO CHAPEU	30.0	13.1	131	133.40
PONTAL 2B	10.8	4.2	42	134.81
VENTOS DO PARAZINHO	30.0	14	140	133.32
PEDRA PRETA	20.7	10.3	101	130.43
REB CASSINO I	24.0	8.9	89	136.59
REB CASSINO II	21.0	8	80	136.60
REB CASSINO III	24.0	9.5	95	136.58
RENASCENCA I	30.0	14	132	136.00
RENASCENCA II	30.0	14.2	126	136.00
RENASCENCA III	30.0	14.1	118	136.00
RENASCENCA IV	30.0	14	112	136.00
VENTOS DE SAO MIGUEL	30.0	12.4	109	136.00
VENTO FORMOSO	30.0	13.5	135	133.40
VENTOS DE TIANGUA	30.0	13.1	131	133.40
VENTOS DE TIANGUA NORTE	30.0	14.1	141	133.40
		Average in BRL/MWh --->		**134.46**

Table 16 – Results of the energy price for wind power projects - auction of August 17th, 2011

Project	Installed capacity (MW)	Assured energy (MW-ave)	Contracted energy (energy lots)	Energy price (BRL /MWh)
IBIRAPUITÃ I	30,0	9.6	96	96.49
CERRO CHATO IV	10,0	3.3	33	97.17
CERRO CHATO V	12,0	4	40	96.85
CERRO CHATO VI	30,0	9.3	93	96.39
DELTA DO PARNAÍBA	28,8	15	148	100.13
PORTO DAS BARCAS	28,8	14.8	89	100.16
PORTO SALGADO	18,0	9.1	91	100.17
CATAVENTOS PARACURU 1	30,0	14.2	142	102.97
EMILIANA	27,2	12.7	45	98.51
JOANA	25,6	12.2	59	98.5
MODELO I	28,8	15.9	36	98.52
MODELO II	24,0	12.4	28	98.53
PAU FERRO	30,0	14.9	55	98.54
PEDRA DO GERÔNIMO	30,0	12.4	36	98.56
TACAICÓ	18,0	8.8	40	98.55
CHUI I	24,0	10.2	102	102.55
CHUI II	22,0	8.9	89	102.89
CHUI IV	22,0	8.8	88	102.91
CHUI V	30,0	12.5	125	103.78
SANTO ANTONIO DE PÁDUA	16,1	8.2	64	104.23
SÃO CRISTOVÃO	29,9	14.2	129	103.79
SÃO JORGE	27,6	13.2	121	103.98
MINUANO I	22,0	9.4	94	101.34
MINUANO II	24,0	10.1	101	100.62
AMETISTA	28,8	13.9	139	98.53
BORGO	19,2	9.7	97	98.53
CAETITÉ	28,8	14.7	143	98.53
DOURADOS	28,8	13.2	132	98.53
ESPIGÃO	9,6	5	49	98.53
MARON	28,8	15.4	138	98.53
PELOURINHO	22,4	11.8	118	98.53
PILÕES	28,8	15.5	131	98.53
SERRA DO ESPINHAÇO	17,6	8.9	89	98.53

CERRO DOS TRINDADE	8,0	2.8	28	97.32
VERACE I	20,0	8.5	85	98.5
VERACE II	20,0	8.3	83	98.64
VERACE III	26,0	11	110	98.19
VERACE IV	30,0	13.1	131	97.74
VERACE IX	30,0	12.7	127	98.21
VERACE V	30,0	12.4	124	98.21
VERACE VI	18,0	7.6	76	98.47
VERACE VII	30,0	12.7	127	97.86
VERACE VIII	26,0	10.8	108	98.19
VERACE X	28,0	12.1	121	98.43
		Average in BRL/MWh --->		**99.38**

Table 17 – Results of the energy price for wind power projects - auction of August 18th, 2011

Project	*Installed capacity (MW)*	*Assured energy (MW-ave)*	*Contracted energy (energy lots)*	*Energy price (BRL /MWh)*
ANGICAL	16	6	60	99.98
CAITITU	20.8	10.5	105	99.98
COQUEIRINHO	22.4	13.5	135	96.97
CORRUPIÃO	22.4	13.7	137	96.97
INHAMBU	25.6	15.5	155	96.97
TAMANDUA MIRIM	24	13.6	136	96.97
TEIU	17.6	8.2	82	99.98
CAIÇARA 2	28.8	14.5	145	100.07
CAIÇARA DO NORTE 1	28.8	13.7	137	100.07
PARQUE EÓLICO LANCHINHA	28	13.2	132	101.68
PARQUE EÓLICO PELADO	20	9	90	100.69
CORREDOR DO SENANDES II	21.6	10.6	106	99.5
CORREDOR DO SENANDES III	27	13.2	132	99.5
CORREDOR DO SENANDES IV	27	12.9	129	99.5
VENTO ARAGANO I	28.8	13.8	138	99.5
VENTOS DE SANTO URIEL	16.1	9	90	101.19
PARQUE EÓLICO DOS ÍNDIOS 2	28	11.5	115	100.01
FAMOSA I	22.5	11.1	104	99.7
PAU BRASIL	15	7.7	71	99.7

ROSADA	30	13.4	128	99.7
SÃO PAULO	17.5	8.1	76	99.7
MALHADINHA 1	22	12.8	120	98.95
MIASSABA 4	28.8	13.5	135	100.07
SANTA HELENA	30	16	160	101.98
SM	30	15.7	157	101.98
VENTOS DE SANTA ROSA	30	13.5	135	99.21
VENTOS DE SANTO INÁCIO	30	13.2	132	100.79
VENTOS DE SÃO GERALDO	30	14.6	146	99.11
VENTOS DE SEBASTIÃO	30	13.4	134	99.69
CARCARÁ 1	28.8	16.3	138	99.92
CARNAÚBAS	27.2	13.1	131	98.92
REDUTO	28.8	14.4	139	98.92
SANTO CRISTO	28.8	15.3	148	98.92
SÃO JOÃO EOL	28.8	14.3	143	98.92
			Average in BRL/MWh --->	**99.58**

Table 18 – Average of the energy price for wind power projects from 2009 to 2011

Years	*Average of the energy price (BRL/MWh)*	*Variation in relation to the previous auction*
2009	148.33	-
2010	128.66	-13.3%
2011	99.48	-22.7%

As can be seen in the tables above, the average of the energy price was BRL 148.33/MWh in 2009, BRL 128.66/MWh in 2010 and BRL 99.48/MWh in 2011. These results clearly demonstrate that the tendency is the decrease in the energy price.

Furthermore, in the next energy auction to be conducted in March 2012 by the Brazilian government, the ceiling price for wind power projects is BRL 112/MWh[30]. Since the Brazilian energy auctions are based on the least tariff criteria, the energy price negotiated in this auction certainly will be lower than BRL 112/MWh. Therefore, it is very unlikely that energy prices for Riachão III and Riachão would surpass BRL 135.78/MWh or BRL 131.94/MWh for Riachão V and III, respectively, for an IRR above benchmark.

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[30] Information available at: <http://www.epe.gov.br/leiloes/Paginas/Leil%C3%A3o%20de%20Energia%20A-3%202012/AneelaprovaeditaldoLeil%C3%A3odeEnergiaA-32012.aspx>.

It is worth mentioning that energy auctions promoted by the government are an official reference for the energy prices analysis by energy players in Brazil. Official information regarding electric energy auctions are publicly available and can be obtained at the Chamber of Electric Energy Commercialization's website: <http://www.ccee.org.br/>.

(b) Increase in the project plant load factor (PLF)/assured energy

In the case of Riachão III, the plant load factor is 47.6%, which results in 120,089 MWh/year. For Riachão V, the plant load factor is 49.1% and, therefore, the net electricity delivered to the grid is 123,873 MWh/year. These plant load factors and net electricity generated by the projects are considered in the project cash flow and are based on the Wind Certification issued by GL Garrad Hassan Ibérica S. L. U. in November 2011.

For an IRR higher than the benchmark, the PLF / assured energy of the projects should be 20% for Riachão III and 16% for and Riachão V. Since the PLFs considered in the project cash flow are based on the Wind Certification considering six years of monitored data[31], the PLFs are not expected to increase.

It is important to mention that it is the project sponsor and Brazilian government interest that the project shall be designed based on the maximum installed power and energy generation of the power plant (the project cannot be inefficient, should be implemented as effectively as possible). Therefore, the figure used by the Project Participants is not underestimated.

(c) Reduction in project operational costs

Operational costs presented in the project cash flow are composed of ANEEL fee, operational costs, land rental, environmental/managerial costs, insurance and transmission cost. Values considered in the project cash flow are based on the following source of information:

→ ANEEL fee ("TFSEE" from the Portuguese *Taxa de Fiscalização de Serviços de Energia Elétrica*) is based on ANEEL Dispatch nr. 360 dated February 4th, 2011.

→ Transmission costs ("TUSD" from the Portuguese *Tarifa de Uso do Sistema de Distribuição*) are based on the ANEEL Resolution nr. 1,139 dated April 19th, 2011>.

→ Land rental is based on contracts signed in April 2010.

→ Insurance and O&M costs are based on quotations received by the project owner between June and August 2011.

→ Environmental/managerial costs are based on the project owner's expectation.

Considering the project cash flow, total operational costs of Riachão III and V result in BRL 3.3 MM per year for each power plant. A reduction in the project operational costs until the IRR reaches the benchmark would result in a decrease of 78% in the case of Riachão III and 64% for Riachão V.

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[31] Information presented in the Wind Certification (page 60 of the pdf document). File: "237522-BRPA-T-01-B-Nota técnica EPE & Relatorio Riachão III e V".

However, as previously explained, ANEEL fee and transmission costs are based on the Brazilian regulations and, therefore, a significantly increase in these taxes is not expected to occur. The values considered for the land rental are based on contracts already signed by the project owner and, therefore, an increase in the values is not expected to occur. Insurance and O&M costs are based on quotations received by the project owner and, it is not expected to increase. It is important to mention that the O&M costs considered in the project cash flow are fixed and, therefore, conservatively considered since these costs increase during the project lifetime considering the increased wear of equipment.

The environmental and managerial costs considered for the cash flow are based on the expectation from the project owner. Since these costs represent only 1% of revenues, it does not have a significantly impact in the IRR calculation.

(d) Reduction in project investment

Investment presented in the project cash flow is based on quotations received by the project owner. The investment results in approximately BRL 92 MM for each project. For the IRR reaches the benchmark, a reduction of around 20% and 17% in the investment considered for Riachão III and Riachão V, respectively, is required. If these variations are considered, the investment would be BRL 73.4 MM in the case of Riachão III and 76.3 MM for Riachão V.

However, real investment in developing countries is usually higher than the original estimative. This may be evidenced from the estimation of construction costs and schedules in developing countries. Using a sample of 125 projects, Bacon and Besant-Jones (1998)[32] indicates that although the ratio of actual to estimated cost can be smaller than one (indicating actual investment smaller than estimated), less than 10% of the analyzed projects had investments lower than those forecasted. One of the conclusions is that "*the estimated values were significantly biased below actual values*".

Considering the information above, values used in the project cash flow are reasonable considering that they are based on quotations from equipment manufacturers and actual investments are usually higher than estimated ones. Therefore, a 17%-20% reduction in the project investment is not expected to occur.

All information used in this sensitivity analysis is presented in the spreadsheets and was presented to DOE during the project validation.

Outcome*:* The IRRs of Riachão III and Riachão V without being registered as a CDM project is below the benchmark, demonstrating that the project activity is not financially attractive for the investor even when parameters change in favor of the project. Thus, the alternative of the project developer is not to invest in the project.

[32] R. W. Bacon and J. E. Besant Jones (1998). Estimating construction costs and schedules – Experience with power generation projects in developing countries. Energy Policy, vol. 26, no 4, pp 317-333.

SATISFIED/PASS – Proceed to Step 3

Step 3. Barrier analysis

Not applicable.

Step 4. Common practice analysis

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

According to the methodological tool "Demonstration and assessment of additionality":

"*Projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc*".

Furthermore, the methodological tool "Demonstration and assessment of additionality" presents a stepwise approach for common practice based on the measures below:

(a) Fuel and feedstock switch;
(b) Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies);
(c) Methane destruction;
(d) Methane formation avoidance.

Considering the measures presented above, the proposed project activity applies option (b) since the project consists of a switch from grid electricity generation to electricity generation from wind source[33].

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

The proposed project activity encompasses two wind power plants, each one with 28.8 MW installed capacity. Therefore, projects with a range between 14.4 MW and 43.2 MW installed capacity were taken into consideration. However, if we consider the installed capacity of the proposed project activity (which comprises both plants), we have 57.6 MW installed capacity and, therefore, a range between 28.8 and 86.4 MW installed capacity. For conservativeness reasons, the Project Participants analyzed power plants with a range between 14.4 MW (the lowest capacity between ranges) and 86.4 MW installed capacity (the highest capacity between ranges).

[33] Analogously to the example presented in Annex 8 of the EB 62.

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

In order to conduct the analysis of Step 2, the Project Participants considered the definitions of geographical area and output as presented in the methodological tool "Demonstration and assessment of additionality".

(i) Output

The additionality tool defines output as "*goods or services with comparable quality, properties, and application areas (e.g. clinker, lighting, residential cooking)*". Therefore, in the case of the proposed project activity, the output considered is the renewable electricity generated by grid-connected wind power plants.

(ii) Applicable geographical area

The additionality tool states:

> "*Applicable geographical area covers the entire Host Country as a default; if the technology applied in the project is not country specific, then the applicable geographical area should be extended to other countries*".

The technology to be used in the project activity is not country specific. Nevertheless, some important aspects regarding the technology shall be considered. Brazil has an extension of 8,514,876.599 square kilometres[34] (with over 4,000 km distance in the north-south as well as in the east-west axis) and 6 distinct climate regions: sub-tropical, semi-arid, equatorial, tropical, highland-tropical and Atlantic-tropical (humid tropical). These varieties of climate obviously have strong influence in the technical aspects related to a wind power plant implementation since "*climate affects all major aspects of the electric power sector from electricity generation, transmission and distribution system to consume demand for power*"[35].

Topography is another parameter which shall be taken into account, since it has influence in the costs involved in the project. ANEEL (2005) presents 5 groups of wind energy generation which varies depending of the project topography (forestlands, open fields, coasts, hills and mountains)[36].

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[34] Available at: http://www.ibge.gov.br/home/geociencias/areaterritorial/principal.shtm.

[35] VESELKA, T. D. Balance power: A warming climate could affect electricity. Geotimes. Earth, energy and environment news. American Geological Institute: August, 2008. Available at: <http://www.agiweb.org/geotimes/aug08/article.html?id=feature_electricity.html>.

[36] ANEEL (2005). "Atlas de energia elétrica" – 2nd ed. Information available at: < http://www.aneel.gov.br/aplicacoes/atlas/pdf/06-Energia_Eolica(3).pdf>.

However, since all regions of the country have some potential to generate electricity using wind – where the highest wind power potential is located in the northeastern region of the country (Figure 4) – the assessment was conducted considering projects located in the Host Country.

Figure 4 - Brazilian wind resource potential

Source: ANEEL, 2008[37]

Based on the criteria above, the ANEEL's database was checked[38]. The analysis resulted in 22 operational wind power plants considering the range identified in Step 1 (between 14.4 and 86.4 MW). When excluding registered CDM project activities and CDM project activities undergoing validation, 17 wind power plants were left.

It is important to mention that this analysis was conducted based on the most recent information available at the time of the submission of the PDD to DOE, since the project starting date is expected to occur only in October 2013.

Hence, $N_{all} = 17$.

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

[37] ANEEL - Agência Nacional de Energia Elétrica. **Atlas de energia elétrica do Brasil**. 3ed. – Brasília: Aneel, 2008. Available at <http://www.aneel.gov.br/biblioteca/EdicaoLivros2009atlas.cfm>.

[38] ANEEL (2011b). Fiscalização dos serviços de geração. Acompanhamento da expansão da oferta de geração de energia elétrica. Resumo geral do acompanhamento das usinas de geração elétrica – Version dated December 2011. Available at: http://www.aneel.gov.br/area.cfm?idArea=37&idPerfil=2. Accessed on December, 23rd 2011

According to the additionality tool, different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

(a) Energy source/fuel;

(b) Feed stock;

(c) Size of installation (power capacity):

- (i) Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
- (ii) Small (as defined in paragraph 28 of Decision 1/CMP.2);
- (iii) Large.

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

- (i) Access to technology;
- (ii) Subsidies or other financial flows;
- (iii) Promotional policies;
- (iv) Legal regulations;

(e) Other features, inter alia;

- (i) Unit cost of output (unit costs are considered different if they differ by at least 20%).

Considering the information above, the Project Participants identified the following types of technologies that differ from the proposed project activity:

(a) *Energy source:* given the particularities of wind power generation, only wind power plants were considered for this common practice analysis;

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

- (i) *Promotional Policies:* The Brazilian Federal Government has provided important incentives for wind electricity generation. One of the most recognized ones is the Alternative Electricity Sources Incentive Program ("PROINFA" from the Portuguese *Programa de Incentivo às Fontes Alternativas de Energia Elétrica*). The PROINFA was created through the Law nr. 10,438 dated April 26th, 2002. Among others, one of the initiative's goals was to increase the renewable energy sources share in the Brazilian electricity market, thus contributing to a greater environmental sustainability. In order to achieve such goals, the Brazilian government has designated the federal state-owned power utility Eletrobrás (Centrais Elétricas Brasileiras S/A) to act as the primary off-taker of electric energy generated by alternative energy facilities in Brazil, by entering into long-term Power Purchase Agreements with alternative energy power producers, at a guaranteed price of at least 80% of the average energy supply tariff charged to ultimate consumers. Also, the Brazilian Decree nr. 5,025 dated March 30th, 20041, which regulates the Law nr. 10,438, states that PROINFA aims for the reduction of greenhouse gases as established by the United Nations Framework Convention on Climate Change (UNFCCC) under Kyoto Protocol, contributing to the sustainable development. Therefore, the program is clearly a "Type E-" policy.

Considering explanations above, projects which have been participating in PROINFA cannot be compared with projects which do not receive this type of incentive. Since Riachão III and Riachão V do not receive PROINFA incentive, PROINFA projects were considered as having different technology to the proposed project activity.

(ii) *Legal regulations:* Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 onwards, due to the increase in international interest rates and the lack of state investment capacity, the government started the privatization process. However, by the end of 2000 results were still modest. Further initiatives, aiming to improve electric generation in the country, were taken from the late 1990's to 2003; however they did not attract new investment to the sector. In 2003 the recently elected government decided to fully review the electricity market institutional framework in order to boost investments in the electric energy sector. The market rules were changed and new institutions were created such as Energetic Research Company ("EPE" from the Portuguese *Empresa de Pesquisa Energética*) – an institution that would become responsible for the long term planning of the electricity sector with the role of evaluating, on a perennial basis, the safety of the supply of electric power – and Chamber for the Commercialization of Electric Power (CCEE) – an institution to manage the commercialization of electric power within the interconnected system. This new structure was approved by the House of Representatives and published in March of 2004[39]. Given the new regulatory framework and investment climate only projects starting after March of 2004 will be considered similar to the proposed project activity. Projects that started operations before the new electricity framework were considered as having different technology to the proposed project activity.

Within the plants identified in the Step 2, considering the range between 14.4 and 86.4 MW of installed capacity, all of them started operations after the new regulatory framework (March 2004).

However, all of them received incentives from PROINFA, identified as a Promotional Policy as explained above.

Therefore, $\boldsymbol{N_{diff}}$ **= 17**.

Step 4: Calculate factor F=1- N_{diff} /N_{all} representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity. The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff} is greater than 3.

Since N_{diff} = 17 and N_{all} = 17:

$N_{all} - N_{diff} = 0 < 3$ and,

$F = 1- N_{diff} /N_{all} = 0 < 0.2$

Therefore, proposed project activity is not a common practice.

Spreadsheet with complete research of the common practice analysis is available with the Project Participants and was presented to DOE during validation.

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

The result presented in sub-step 4a demonstrates the increased development of wind energy technology in Brazil since almost all wind plants started operations after the new regulatory framework (mainly in 2010 year). However, all of them receive some kind of incentive (MDL and/or PROINFA) which indicates that risks related to this type of project are higher, as discussed in Step 2 – Investment Analysis, and that a strong incentive is required to promote the construction of renewable energy projects in Brazil, where it includes wind power plants.

According to the Brazilian Power Regulatory Agency (ANEEL) information, there are 57 operational wind power projects in Brazil[40]. These wind power plants represent 0.97% of the Brazilian electricity matrix, *i.e.* 1 GW installed capacity of the total 115.3 GW (Figure 5).

[39] <http://www.planalto.gov.br/ccivil_03/_ato2004-2006/2004/lei/l10.848.htm>.

[40] ANEEL. Capacidade de geração Brasil. Empreendimentos em operação – eólica. Banco de Informação de Geração – BIG. Information available at: < http://www.aneel.gov.br/ >.

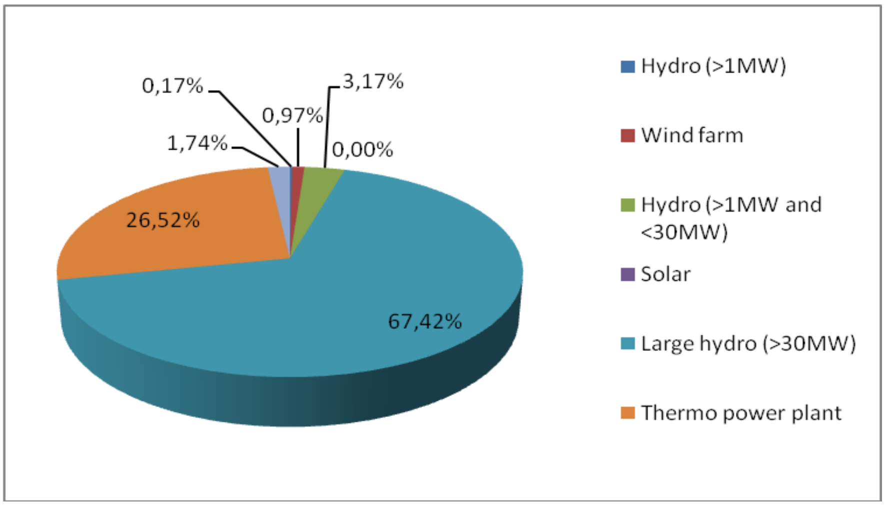

Figure 5 – Brazilian electricity matrix as of August 2011

Source: ANEEL, (2011)[41]

In summary, this project activity is clearly not common practice, because no similar project activities were identified.

SATISFIED/PASS – Project is ADDITIONAL

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission reductions (ER_y)

According to ACM0002 emission reductions by the proposed project activity are calculated as follows.

$$ER_y = BE_y - PE_y$$ **Equation 1**

Where,

ER_y = Emission reductions in year *y* (t CO_2e);

BE_y = Baseline emissions in year *y* (t CO_2);

PE_y = Project emissions in year *y* (t CO_2e).

[41] ANEEL (2011). Banco de Informações de Geração - BIG. Capacidade de Geração. <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp>. Accessed on August 24th, 2011.

Baseline emissions (BE_y)

Baseline emissions are calculated as follows:

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

Where,

BE_y = Baseline emissions in year *y* (tCO_2);

$EG_{PJ,y}$ = 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);

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh).

For Greenfield projects as it is the case of the proposed project activity $EG_{PJ,y}$ is determined as follows.

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

Where,

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh);

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh).

Explanations as to how the quantity of net electricity generation supplied by the project plant/unit to the grid ($EG_{facility,y}$) was estimated is presented below in section B.6.3. The calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$) follows, as recommended by ACM0002, the procedures established in the methodological tool "*Tool to calculate the emission factor for an electricity system*".

According to this tool Project Participants shall apply six steps in order to calculate the baseline emission factor as further detailed below.

- **STEP 1 -** Identify the relevant electricity systems

According to the tool, "*If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD*".

The Brazilian DNA published Resolution nr. 8, issued on May 26th, 2008, defines the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence this figure will be used to calculate the baseline emission factor of the grid.

- **STEP 2** – Choose whether to include off-grid power plants in the project electricity system (optional).

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.

Option I of the tool is chosen, which is to include in the calculation only grid power plants.

- **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 OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

Dispatch data analysis in not an available option for the calculation of the operating margin since it is only applicable for the *ex-post* vintage. The simple operating margin can only be used where low-cost/must-run resources[42] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normals for hydroelectricity production. Table 19 shows the share of hydroelectricity in the total electricity production for the Brazilian interconnected system. However, the results show the non-applicability of the simple operating margin to the proposed CDM Project Activity.

[42] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

Table 19 - Share of hydroelectricity generation in the Brazilian interconnected system, 2006 to 2010

Year	Share of hydroelectricity (%)
2006	91.81%
2007	92.79%
2008	88.62%
2009	93.27%
2010	88.77%

Source: ONS, 2011[43]

The fourth alternative, an average operating margin, is an oversimplification and does not reflect at all the impact of the project activity in the operating margin. Therefore, the simple adjusted operating margin will be used in the project.

- **STEP 4 -** Calculate the operating margin emission factor according to the selected method

According to the tool "*the simple adjusted OM emission factor ($EF_{grid,OM-adj,y}$) is a variation of the simple OM, where the power plants / units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m).*"

The simple adjusted OM was calculated based on the net electricity generation and a CO_2 emission factor for each power unit – i.e. similarly to **Option A** of the simple OM method – as follows:

$$EF_{grid,OM-adj,y} = (1-\lambda_y) \cdot \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y \cdot \frac{\sum_k EG_{k,y} \times EF_{EL,k,y}}{\sum_k EG_{k,y}} \quad \textbf{Equation 4}$$

Where,

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year *y* (tCO2/MWh)

λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year *y*

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

[43] Operador Nacional do Sistema: Histórico de Geração (2011). Available at <http://www.ons.org.br/historico/geracao_energia.aspx>.

$EG_{k,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{EL,k,y}$	=	CO_2 emission factor of power unit *k* in year *y* (tCO_2/MWh)
m	=	All grid power units serving the grid in year *y* except low-cost/must-run power units
k	=	All low-cost/must run grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$

Considering that only data on electricity generation and the fuel types used in each of the power units was available, the emission factor was be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as per **Option A2** of the tool. The following formula was used:

$$EF_{EL,m,y} = \cdot \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}}$$ **Equation 5**

Where,

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All power units serving the grid in year *y* except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

Information used to determine this parameter was supplied by The Electric System National Operator (from the Portuguese *Operador Nacional do Sistema – ONS*), which is an official source, as recommended by the tool. ONS is an entity of private right, non-profitable, created on August 26th 1998, responsible for coordinating and controlling the operation of generation and transmission facilities in the

National interconnected Power System (NIPS) under supervision and regulation of the Electric Energy National Agency (ANEEL)[44].

- **STEP 5 -** Calculate the build margin (BM) emission factor

The build margin emission factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available.

The sample group of power units *m* used to calculate the build margin shall be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEGtotal, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh);

(c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SETsample);

Identify the date when the power units in SETsample started to supply electricity to the grid. If none of the power units in SETsample started to supply electricity to the grid more than 10 years ago, then use SETsample to calculate the build margin. Ignore steps (d), (e) and (f).

Otherwise:

(d) Exclude from SETsample the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set (SETsample-CDM) the annual electricity generation (AEGSET-sample-CDM, in MWh);

If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (*i.e.* AEGSET-sample-CDM ≥ 0.2

[44] http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en

× AEGtotal), then use the sample group SETsample-CDM to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group SETsample-CDM the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set (SETsample-CDM->10yrs).

In terms of vintage, **option 1** is chosen. In this sense, the build margin was calculated using the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE, *i.e.* 2010.

The sample group of power units *m* used to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (*option b*), since this set of plants comprises the larger annual generation.

From the result of the sample group of power units *m*, the BM is calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$ **ation 5**

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh);

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh);

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year *y* (tCO_2/MWh);

m = Power units included in the build margin;

y = Most recent historical year for which power generation data is available.

The CO_2 emission factor of power unit m in year *y* ($EF_{EL,m,y}$) parameter is calculated as determined as per the guidance in step 4 (a) for the simple OM, using options A1, A2 or A3. The build margin was calculated following the same approach described above in step 4, *i.e.* Option A2.

- **STEP 6** – Calculate the combined margin (CM) emissions factor

The calculation of the combined margin (CM) emission factor is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option.

The simplified CM method (option b) can only be used if:

- The project activity is located in a Least Developed Country (LDC) or in a country with less than 10 registered CDM projects at the starting date of validation; and
- The data requirements for the application of step 5 above cannot be met.

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

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

Where,

$EF_{grid,BM,y}$ = 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 the tool, for wind power generation project activities, as is the case of the proposed project activity, weights are w_{OM} = 0.75 and w_{BM} = 0.25.

(b) Simplified CM

The combined margin is calculated using equation 5 above with the following conditions:

- $w_{BM} = 0$;
- $w_{OM} = 1$.

Under the simplified CM, the operating margin emission factor ($EF_{grid,OM,y}$) must be calculated using the average OM (option (d) in step 3 of the “Tool to calculate the emission factor for an electricity system). However, this option is not used in the proposed project activity.

Project emissions (PE_y)

According to ACM0002, *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 for by using the following equation:*

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$ **Equation 7**

Where,

PE_y = Project emissions in year *y* (tCO_2e);

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2);

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

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

Emissions from fossil fuel combustion ($PE_{FF,y}$)

According to the methodology, only geothermal and solar thermal projects have to account emissions from the consumption of fossil fuels. Therefore, in the case of the proposed project activity, $PE_{FF,y}$ = 0 tCO_2.

Emissions from the operation of geothermal power plants due to the release of non-condensable gases ($PE_{GP,y}$)

Considering that the proposed project activity consists on the construction of a wind power plant, there are no emissions related to non-condensable gases from the operation of geothermal power plants. Therefore, $PE_{GP,y}$ = 0 tCO_2e.

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

New hydro electric power projects resulting in new reservoirs, shall account for CH_4 and CO_2 emissions from reservoirs. Considering that the proposed project activity consists of the construction of a wind power plant, there are no emissions from water reservoirs. Therefore, $PE_{HP,y}$ = 0 tCO_2e.

Leakage emissions (LE_y)

According to the methodology, "*no leakage emissions are considered. The main emissions* *potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emissions sources are neglected".* Therefore, leakage emissions related to the implementation of the proposed project activity are 0 tCO_2.

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

Data / Parameter:	$EF_{CO2,m,i,y}$
Data unit:	tCO_2/GJ
Description:	CO2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Large amount of data. Please refer to the emission factor calculation spreadsheet which is attached to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the recommendation of the *"Tool to calculate the emission factor for an electricity system"*. IPCC default values are being used since this information is neither provided by fuel suppliers nor regional and/or local default values are publicly available.
Any comment:	-

Data / Parameter:	$EG_{m,y}$ **and** $EG_{k,y}$
Data unit:	MWh
Description:	Net electricity generated by power plant/unit *m* or *k* in year *y*
Source of data used:	Official publications. Data from the Electric System National Operator was used.
Value applied:	Large amount of data. Please refer to the emission factor calculation spreadsheet which is attached to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex-ante* option).
Any comment:	For methodological choices details, please refer to section B.6.1.

Data / Parameter:	$\eta_{m,y}$
Data unit:	-
Description:	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data used:	Default values provided in Annex 1 of the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	Large amount of data. Please refer to the emission factor calculation

	spreadsheet which is attached to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the recommendation of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section B.6.1.

Data / Parameter:	$EF_{grid,OM\text{-}adj,y}$
Data unit:	tCO_2/MWh
Description:	Simple adjusted operating margin CO_2 emission factor in year *y*
Source of data used:	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.2644
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section B.6.1.

Data / Parameter:	$EF_{BM,2010}$
Data unit:	tCO_2/MWh
Description:	Build Margin CO_2 emission factor in year *y*
Source of data used:	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.1166
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section B.6.1.

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
Source of data:	0.2275 tCO_2/MWh

	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*.
Measurements procedures (if any)	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*. For methodological choices details, please refer to section B.6.1.
Any comment:	-

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

Baseline emissions (BE_y)

As mentioned in section B.6.1, $EG_{PJ,y} = EG_{facility,y}$. Estimated quantity of net electricity generation supplied by the project plants is presented below:

Table 20 – Electricity delivered to the grid and plant load factor (PLF) of Riachão III and Riachão V

Description	*Riachão III*	*Riachão V*
Plant Load Factor (PLF)	47.6%	49.1%
Estimated electricity delivered to the grid	120,089 MWh/year	123,873 MWh/year

Source: GL Garrad Hassan Ibérica S. L. U., 2011

The electricity delivered to the grid and the planto load factors of Riachão III and Riachão are based on the Wind Certification issued by GL Garrad Hassan Ibérica S. L. U. and dated November 14th, 2011. Therefore, the proposed project activity applies option (b) of the "Guidelines for the reporting and validation of plant load factors", *i.e.* "*the plant load factor determined by a third party contracted by the project participants (e.g. an engineering company)*".

Additionally, the calculation of the combined margin CO_2 emission factor for grid connected power generation ($EF_{grid,CM,y}$) follows the steps established in the "*Tool to calculate the emission factor for an electricity system*". The results are presented below.

- **STEP 1 -** Identify the relevant electricity systems

Following Resolution #8, issued by the Brazilian DNA on 26th May, 2008, the Brazilian Interconnected Grid corresponds to the system to be considered. It covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest) as presented in the figure below.

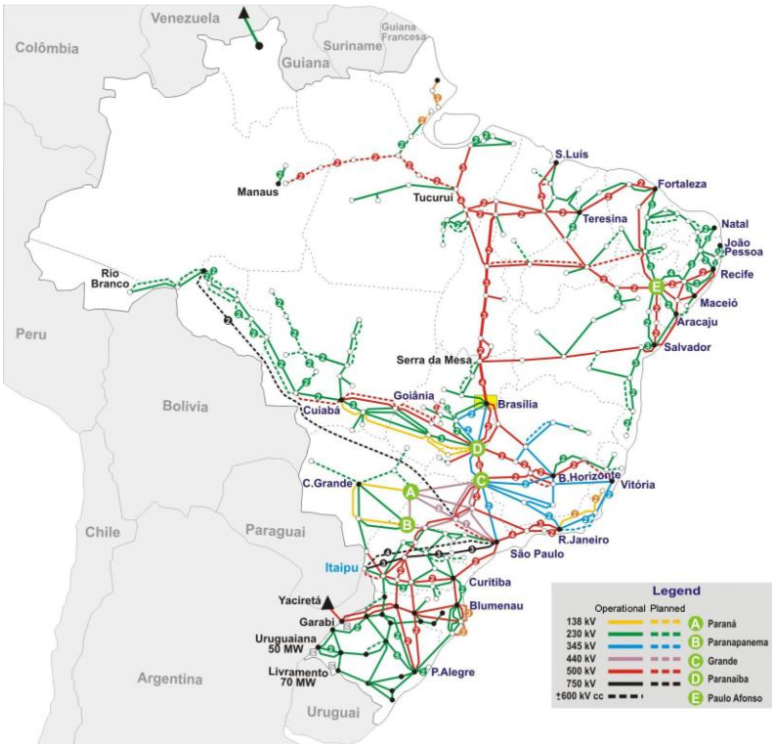

Figure 6 – Brazilian Interconnected System

Source: ONS, 2011[45]

- **STEP 2** – *Choose whether to include off-grid power plants in the project electricity system (optional)*

  Option I was chosen and only grid connected power plants are considered.

- **STEP 3 -** *Select a method to determine the operating margin (OM)*

The simple adjusted operating margin was chosen method for the calculation of this parameter. Please refer to section B.6.1. for the proper justification.

- **STEP 4 -** Calculate the operating margin emission factor according to the selected method

A spreadsheet containing all data used to determine the operation margin was supplied to the DOE. The result is presented below.

$$EF_{grid,OM\text{-}adj,y} = 0.2644\ tCO_2e/MWh$$

[45] Electric System National Operator (from the Portuguese *Operador Nacional do Sistema Elétrico – ONS*). Mapas do SIN. Information available at: <http://www.ons.org.br/>. Accessed on May 13th, 2011.

- **STEP 5 -** Calculate the build margin (BM) emission factor

As described above in section B.6.1., the *ex-ante* vintage was the option chosen to determine the build margin (option 1).

The sample group of power units *m* used to calculate the build margin was identified following the procedure provided by the tool. The result is discussed below and is detailed presented in the spreadsheet supplied to the DOE which is also attached to the PDD.

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

From the most recent consolidated information the $SET_{5\text{-}units}$ are: UTE Linhares, UHE Salto Pilão, UTE Camaçari, UTE Tocantinópolis and UTE Viana. The electricity generated by these set of plants ($AED_{SET\text{-}5\text{-}units}$) in 2010 was 662,143 MWh.

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

Not considering the CDM project activities, in 2010, the Brazilian electricity System generated (AEG_{total}) 465,919,678 MWh. A large amount of plants comprise 20% of AEG_{total}. This information ($SET_{\geq 20\%}$) can be checked in the calculation spreadsheet attached to this PDD. The annual electricity generation of $SET_{\geq 20\%}$, corresponding to the parameter $AEG_{SET\text{-}\geq 20\%}$, is 93,183,936 MWh.

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. Ignore steps (d), (e) and (f).

From data presented in items (a) and (b), it can be observed that $SET_{\geq 20\%}$ is greater than $SET_{5\text{-}units}$. Therefore, SET_{sample} corresponds to $SET_{\geq 20\%}$. The oldest plant comprised in SET_{sample} started to supply electricity to the grid in January 1998. Hence, steps *(d), (e)* and *(f)* of the tool are applicable.

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project

electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample-CDM}$) the annual electricity generation ($AEG_{SET-sample-CDM}$, in MWh);

Plants which have started to supply electricity to the grid more than 10 years ago were excluded. Four registered CDM Projects were included in the SET_{smaple}. The electricity generation by resultant set of plants, corresponding to the parameter $AEG_{SET-sample-CDM}$, is 74,902,471MWh.

If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET-sample-CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample-CDM}$ to calculate the build margin. Ignore steps (e) and (f).

From the results presented above, $AEG_{SET-sample-CDM}$ is lower than AEG_{total}. Then, steps (e) and (f) were applied.

(e) *Include in the sample group $SET_{sample-CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);*

(f) *The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample-CDM->10yrs}$).*

Five power plants that have started to supply electricity to the grid more than 10 years ago were included. The resultant set is $SET_{sample-CDM->10yrs}$ is identified in the grid emission factor calculation spreadsheet.

The build margin was calculated following the same approach described above in step 4, and considering the set of plants identified above. Please refer to the spreadsheet attached to the PDD for the calculations. The result is presented below.

$$EF_{grid,BM,y} = 0.1166\ tCO_2e/MWh$$

- **STEP 6 –** Calculate the combined margin (CM) emissions factor EF_y.

Applying the results presented above in STEPS 4 and 5 above to the Equation 6 presented in section B.6.1. and considering the weights $w_{OM} = 0.75$ and $w_{BM} = 0.25$ we obtain,

$$EF_{grid,CM,y} = 0.75 \times 0.2644 + 0.25 \times 0.1166\ tCO_2e/MWh$$

$$EF_{grid,CM,y} = 0.2275\ tCO_2e/MWh$$

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

$$BE_y = EG_{facility,y} \times EF_{grid,CM,y}$$

(i) *Riachão III*

120,089 *MWh/year* × 0.2275 tCO_2e/MWh = 27,320 tCO_2

(ii) *Riachão V*

123,873*MWh/year* × 0.2275 tCO_2e/MWh = 28,181 tCO_2

Project emissions (PE_y)

As explained above in section B.6.1. project emissions by the proposed project activity are **zero**.

PE_y = 0 tCO_2e.

Leakage emissions (LE_y)

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

LE_y = 0 tCO_2

Emission reductions (ER_y)

Applying the results discussed above to Equation 1 we obtain,

$$ER_y = BE_y - PE_y$$

(i) *Riachão III*

27,320 tCO_2 - 0.00 tCO_2e/MWh = 27,320 tCO_2e

(ii) *Riachão V*

28,181 tCO_2 - 0.00 tCO_2e/MWh = 28,181 tCO_2e

ER_y = 55,501 tCO_2e

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

Table 21 – Estimation of project emissions, baseline emissions, leakage and emission reductions during the first crediting period of the project activity

Years	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
Year 1 - (2014)*	0.00	9,274	0.0	9,274
Year 2 - (2015)	0.00	55,501	0.0	55,501
Year 3 - (2016)	0.00	55,501	0.0	55,501
Year 4 - (2017)	0.00	55,501	0.0	55,501
Year 5 - (2018)	0.00	55,501	0.0	55,501
Year 6 - (2019)	0.00	55,501	0.0	55,501
Year 7 - (2020)	0.00	55,501	0.0	55,501
Year 8 - (2021)**	0.00	46,225	0.0	46,225
Total (tonnes of CO_2e)	**0.00**	**388,505**	**0.0**	**388,505**

*Starting on November 1st

**Until October 30th

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

B.7.1 Data and parameters monitored:

Data / Parameter:	***$EG_{facility,y}$***
Data unit:	MWh/year
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*.
Source of data to be used:	Sales of receipt, documented evidence from the local power utility or CCEE – Câmara de Comercialização de Energia Elétrica, a Brazilian governmental entity which monitors the quantity of electricity in the national interconnected grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Riachão III: 120,089 Riachão V: 123,873 Based on Wind Certification issued by GL Garrad Hassan Ibérica S. L. U. and dated November 14th, 2011.
Description of measurement methods and procedures to be applied:	The quantity of electricity delivered to the grid by the project will be quantified through the energy meter located at the substation (net energy).
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirements extremely low level of uncertainty – 0.2 precision class). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured.
Any comment:	Since the proposed project activity is a greenfield project, as explained in section B.6.1., this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

B.7.2. Description of the monitoring plan:

The Project owner will proceed with the necessary monitoring measures as established in the procedures from the Electric System National Operator (“ONS” from the Portuguese *Operador Nacional do Sistema*), Brazilian Electricity Regulatory Agency (“ANEEL” from the Portuguese *Agência Nacional de Energia Elétrica*) and the Electric Power Commercialization Chamber (“CCEE” form the Portuguese *Câmara de Comercialização de Energia Elétrica*).

The ONS is the entity responsible for coordinating and controlling the operation of generation and transmission facilities in the National interconnected Power System under supervision and regulation of ANEEL[46] which is the regulatory agency providing favourable conditions for the electric power market to develop a balance between the agents and the benefit of society[47]. CCEE is a not-for-profit, private, civil organization company that is in charge of carrying out the wholesale transactions and commercialization of electric power within the NIPS, for both Regulated and Free Contracting Environments and for the spot market[48].

The total electricity exported to the grid will be monitored following the procedures and requirements established by ONS which defines the technical characteristics and precision class (0.2% of maximum permissible error) of the electricity meters to be used[49]. In addition, ONS also rules about the electricity meter calibration requirements (every two years)[50].

There will be two energy meters (principal and backup) located at the substation, as specified by CCEE. Before the operation starts, CCEE demands that these meters are individually registered within their system and calibrated by an entity with Rede Brasileira de Calibração (RBC) credential. Beyond that, energy information will be controlled in real time by CCEE. Once the measurement points are physically defined and the invoice measurement system and the communication infrastructure are installed, the measurement points will be registered in the SCDE (System of Energy Data collection) managed by CCEE.

As mentioned before, CCEE makes feasible and regulates the electricity energy commercialization in Brazil. In a process called Accounting Commensuration Aggregation (from the Portuguese *Agregação Contábil da Medição*) CCEE compares the energy generation reported by every seller connected to the national grid with the consumption registered during the month under consideration. After the

[46] Information available at <http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en>.

[47] Information available at <http://www.aneel.gov.br/>.

[48] Information available at <http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=25afa5c1de88a010VgnVCM100000aa01a8c0RCRD>.

[49] ONS – Operador Nacional do Sistema. Procedimentos de Rede – Módulo 12: medição para faturamento / Submódulo 12.2: Instalação do sistema de medição para faturamento. Available at http://www.ons.org.br/procedimentos/modulo_12.aspx.

[50] ONS – Operador Nacional do Sistema. Procedimentos de Rede – Módulo 12: medição para faturamento / Submódulo 12.3: Manutenção do sistema de medição para faturamento. Available at http://www.ons.org.br/procedimentos/modulo_12.aspx.

adjustments due to energy losses occurring in the transmission system are made, CCEE issues several official reports certifying the amount of energy generated by each seller.

Moreover, to confirm CCEE's information, every month the company auditing CCEE's reports randomly selects a sample of sellers that have to provide detailed information of their Power Purchase Agreement(s) and energy generation during the month being analyzed. Then the auditors analyse the information, check whether CCEE's calculation is correct and issue an opinion. The independent auditors' statements confirming CCEE's information are available at CCEE's website.

The final results of electricity generation are published at CCEE's website and are publicly available. Hence, CCEE's information - which is an official and publicly available source – is going to be used to cross-check information monitored by the project participant.

The company that owns the wind farm will be the responsible for data collection and archiving as well as the calibration and maintenance of the monitoring equipment, for dealing with possible monitoring data adjustments and uncertainties, review of reported results/data, internal audits of GHG project compliance with operational requirements and corrective actions. Also, it is responsible for the project management, as well as for the organising and training of the staff in the appropriate monitoring, measurement and reporting techniques.

It is important to mention that ANEEL can visit the plant to inspect the operation and maintenance of the facilities at any time.

Studies done during the design phase of the project activities have shown the environmental impacts and the interference on the social development in the region of the plant, indicating the mitigation measures to be adopted during the construction phase. These measures are being taken rigorously. Data about environmental impact is being archived at the power plant and the environmental agencies.

Additionally, the Project predicts an environmental plan that involves different programs during its operation. Further, after the beginning of the commercial operations, renovation of degraded areas and permanent preservation areas will be carried out according to the regulations of the environmental agencies, through a team of environment experts.

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

Date of completing the baseline section and the monitoring methodology (DD/MM/YYYY): 05/04/2012.

Name of person/entity determining the baseline:

Company:	Ecopart Assessoria em Negócios Empresariais Ltda. (EQAO)
Address:	Rua Padre João Manoel, 222
Zip code + city:	01411-000 São Paulo, SP
Country:	Brazil

Telephone number: +55 (11) 3063-9068
Fax number: +55 (11) 3063-9069
E-mail: info@eqao.com.br

Ecopart Assessoria em Negócios Empresariais Ltda. is Project Advisor and Project Participant.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

30/10/2013.

This date corresponds to the estimated date for the signature of the Engineering, Procurement and Construction (EPC) contract.

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

20 years – 0 month

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

C.2.1. Renewable crediting period:

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

01/11/2014

C.2.1.2. Length of the first crediting period:

7 years -0 month.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

In Brazil, the sponsor of any project that involves construction, installation, expansion or operation of any polluting or potentially polluting activity or any other capable to cause environmental degradation is obliged to secure a several permits from the relevant environmental agency (federal and/or local, depending on the project).

The environmental impact of the Project is considered small given the other sources of electricity generation. Power plants project with installed capacity greater than 10 MW must do the environmental impact assessment and respective environmental impact report in order to obtain the necessary licenses to the project.

Licenses required by the Brazilian environmental regulation (National Environmental Council Resolution – from the Portuguese CONAMA - *Conselho Nacional do Meio Ambiente* nr. 237/97[51]) are:

- The preliminary license (*Licença Prévia* or LP);
- The construction license (*Licença de Instalação* or LI); and
- The operating license (*Licenca de Operação* or LO).

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

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

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

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

As mentioned in section B.5, the project activity has the Preliminary Licenses issued by the environmental agency of Rio Grande do Norte (*Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte - IDEMA*): Riachão III nr.0077/2010 and Riachão V nr. 0079/2010.

[51] Available at: http://www.mma.gov.br/port/ conama/res/res97/res23797.html.

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

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

As mentioned in section D.1, power plants with installed capacity greater than 10 MW have to do an environmental impact assessment and a respective environmental impact report in order to obtain the necessary licenses to the project. Given the project already possesses the preliminary environmental license, it can be concluded that it does not indicate in significant negative transboundary environmental impacts; otherwise the license would not have been issued by the environmental agency.

SECTION E. Stakeholders' comments

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

The Brazilian Designated National Authority "*Comissão Interministerial de Mudança Global do Clima*", requests comments from local stakeholders, and the validation report issued by an authorized DOE according to the Resolution nr. 7, issued on March 5th, 2008, in order to provide the Letter of Approval.

The Resolution determines the direct invitation for comments sent by the project proponents at least to the following agents involved in and affected by project activities and at least 15 days before the Global Stakeholder Process (GSP):

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

Invitation letters were sent to the following agents (copies of the letters and post office confirmation of receipt communication are available upon request and will be supplied to the DOE validating the Project Activity):

- *Prefeitura de Ceará-Mirim* (Ceará-Mirim City Hall)
- *Câmara Municipal de Ceará-Mirim*
  (Municipal Assembly of Ceará-Mirim)
- *Secretaria do Meio Ambiente de Ceará-Mirim*
  (Environmental Agency of Ceará-Mirim)
- *Associação comunitária de Desenvolvimento do Vale de Ceará-Mirim*
  (Local communitatian association)
- *Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte - IDEMA*
  (Environmental Agency of Rio Grande do Norte State)
- *Ministério Público de Rio Grande do Norte*
  (State Attorney for the Public Interest of the State of Rio Grande do Norte)
- *Fórum Brasileiro de ONGs e Movimentos Sociais para o Desenvolvimento e Meio Ambiente*
  (Brazilian Forum of NGOs and Social Movements for the Development and Environment)

In the letter sent to the stakeholders mentioned above, the Project Participants informed the link where the Project Design Document and the "Anexo III" report were available in Portuguese for consultation and comments. “Anexo III” is a report containing information related to the contribution of the proposed project activity to sustainable development. In addition, the link where the project would be available for GSP and the contact information of the project participants were also included in the letter sent to local stakeholders.

Furthermore, the PDD of the project was made available for comments at the validation stage at the United Nations Framework Convention on Climate Change (UNFCCC) website: <http://cdm.unfccc.int/Projects/Validation/index.html>.

E.2. Summary of the comments received:

As mentioned in section E.1, the Project Participants conducted the local stakeholder process mailing letters for the local entities where Riachão III and Riachão V will be located, informing the link where the PDD and “Anexo III” report (both in Portuguese) were available and the contact information which stakeholders could consult, send comments or make questions related to the proposed project activity, as required by the Brazilian DNA in order to issue the Letter of Approval.

Regarding this stakeholder process, only one letter was received. The Project Participants received the official letter nr. 893/2011 – 4ª CCR dated October 26th, 2011 and signed by Mario José Gisi from the State Attorney for the Public Interest (Federal). In this letter, Mr. Gisi acknowledged receipt of the letter sent by the Project Participants and informed that, due to legal provisions, the State of Attorney cannot provide consultancy to public or private companies and, therefore, they cannot provide any comments related to the above mentioned projects.

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

Since no comments were received in the official letter nr. 893/2011 – 4ª CCR dated October 26th, 2011, no actions were taken by the Project Participants.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

This project is not a diversion of ODA from an Annex 1 country.

Annex 3

BASELINE INFORMATION

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

Annex 4

MONITORING INFORMATION

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

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