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: *Delta do Parnaíba Wind Power Plant Complex CDM Project Activity.*

Version number of the document: 05

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

A.2. Description of the project activity:

The primary objective of the Wind Power Plants considered in this CDM Project Activity 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 consumption for Brazil (and for the region of Latin America and the Caribbean).

The Latin America and the Caribbean region countries have expressed their commitment towards achieving a target of 10% renewable energy for the total energy use in the region. Through an initiative from the Ministers of the Environment in 2002 (UNEP-LAC, 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 to achieve sustainability in accordance with the Millennium Development Goals[2].

The privatization process initiated in 1995 arrived in conjunction with the expectation of adequate tariffs (fewer subsidies) and more attractive prices for generators. It drew the attention of investors to possible alternatives not available in the centrally planned electricity market. Unfortunately the Brazilian energy market lacked a consistent expansion plan, with the biggest problems being political and regulatory uncertainties. At the end of the 1990's a strong increase in demand in contrast with a less-than-average increase in installed capacity caused the supply crisis/rationing from 2001/2002. One of the solutions the government provided was flexible legislation favoring smaller independent energy producers. In addition to this, the possible eligibility under the Clean Development Mechanism of the Kyoto Protocol also drew the attention of investors regarding renewable energy projects.

In this context, the proposed project activity can be seen as an example of a solution by the private sector to the Brazilian electricity crisis of 2001, contributing to the country's sustainable development.

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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. May 15th to 17th, 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.*"

The proposed project activity consists of a wind power complex comprising three Wind Power Plants (WWPs) summing 70MW of installed capacity, as follows: Delta do Parnaíba WPP (30MW), Porto das Barcas WPP (20MW) and Porto Salgado WPP (20MW). These three plants are expected to become operational in March 2013 and are all located in the Parnaíba municipality, Piauí state, northeast region of Brazil.

The wind power plants are a cleaner source of electricity that will also have an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. No electricity was generated in the sites where the wind power plants are going to the implemented. In this sense, the baseline scenario is the same as the scenario existing prior to the implementation of the project activity, which is electricity supplied by the grid (for details as to how the baseline scenario was identified please refer to section B.4). Therefore, the project activity reduces emissions of greenhouse gases (GHG) by avoiding electricity generation from a mix of fossil fuel sources connected to the Brazilian Grid, which would be generated (and emitted) in the absence of the project.

The project contributes to sustainable development since it meets present needs without compromising the ability of future generations to meet their own needs, as defined by the Brundtland Commission (1987)[3]. In other words, the implementation of wind power plants ensures renewable energy generation, reduces the demand on the national electric system, avoids negative social and environmental impacts caused by fossil fuel fired thermo power plants, and drives regional economies, increasing the quality of life in local communities.

In summary, the proposed project activity will contribute to the sustainable development in the following aspects:

- Reducing air pollutants that are emitted from fossil fuel electricity generation from power plants connected to the Brazilian grid;
- Creating job opportunities during the project construction, operation and maintenance, improving capacities related to wind farms in Brazil through advanced technology transferred from developed countries;
- Efficiently generating electricity, for which there is a growing demand in the country;
- Contributing towards national economic development, adding an Independent Power Producer, leading to energy diversification and creation of additional renewable energy sources;

From the above, it can be concluded that the project has reduced environmental impacts and will develop the regional economy, resulting in better quality of life. In other words, environmental sustainability combined with social and economic justice, undeniably contributing to the host country's sustainable development.

A.3. Project participants:

[3] **WCED (1987).** Our Common Future. The World Commission on Environment and Development. Oxford University Press.

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

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

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

Piauí

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

Parnaíba

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.

Geographic Coordinates†	*Delta do Parnaíba*	*Porto das Barcas*	*Porto Salgado*
Longitude (West)	-41.7080	-41.7433	-41.7263
Latitude (South)	-2.8373	-2.8195	-2.8364

†Note: The geographic coordinates here presented are the ones corresponding to the location of the first aerogenerator of each WPP of the complex. The original data is presented in the UTM format. The online tool

http://www.rdtec.com.br/rdgeomg/localmaster.htm was used. The plants are located at 24UTM zone. The information is described in the wind certification conducted by Garrad Hassan.

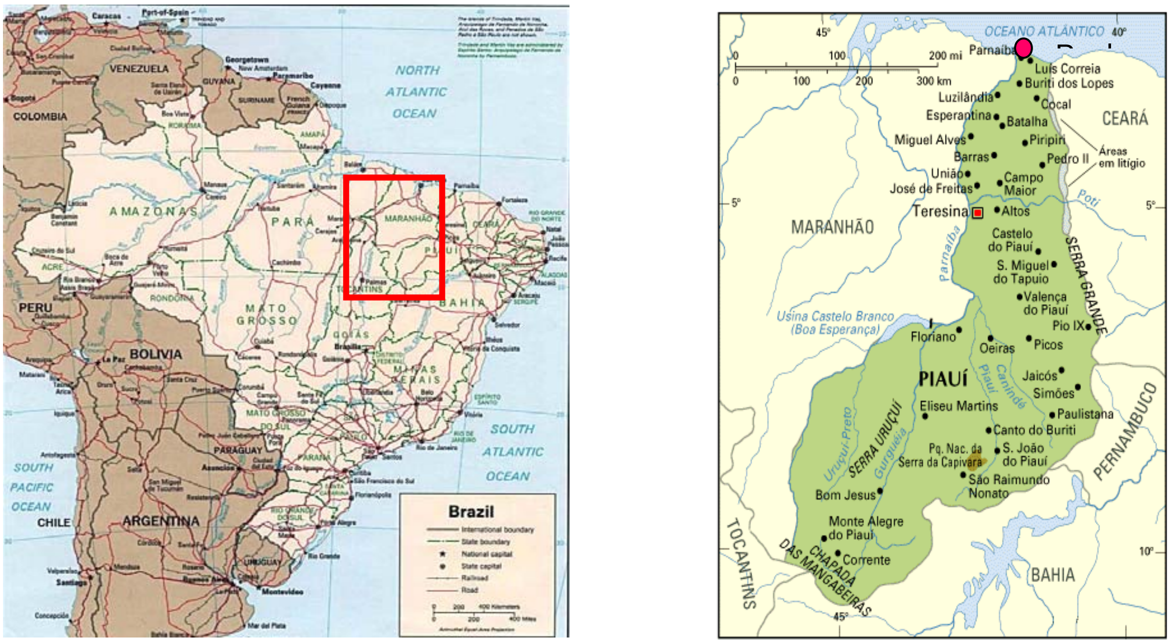

Figure 1 –Piauí state (on the left) and Parnaíba municipality as well as project location (on the right)

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:

The project activity is the wind power complex consisting in the construction of three wind power plants summing 70MW of installed capacity in a site where no electricity was generated prior to their implementation. In this sense, the baseline scenario is the same as the scenario existing prior to the implementation of the project activity, which is electricity supplied by the grid. For details as to how the baseline scenario was identified please refer to section B.4.

As described in sections A.2. and B.3. of this document, the proposed project activity reduces emissions of greenhouse gases (GHG), *i.e.* CO_2, by displacing electricity generation from the mix of fossil fuel sources connected to the Brazilian Grid, which would be generated (and emitted) in its absence.

The project developer has negotiated electricity to be generated by the plants in the 12th New Energy Auction, which took place in August 2011. As per the auction rules, the project developer have to supply at least the same amount of electricity negotiated during the auction. In this sense, modifications in the technical configuration relating to the optimization of the WPPs are allowed[4]. Nevertheless, the final

[4] Modifications are allowed once properly authorized by ANEEL and if the proposed changes do not decrease the guaranteed power negotiated in the tender. This is explicit mentioned in article 14.14 of the A-3 New Energy Auction Public Announcement available

configuration of the complex was optimized and do not corresponds to the technical configuration presented while qualifying the project to participate in the auction. The technology to be employed in each one of the sites, as described in Table 2 below follows the technical description presented in the final results of the Wind Certification conducted by Garrad Hassan.

Table 2 - Project technical description, as of March 2012 (*Source:* Vestas' manual[5]).

Wind Power Plant	*Delta do Parnaíba*	*Porto das Barcas*	*Porto Salgado*
Turbines			
Model	V100	V100	V100
Quantity	15	10	10
Nominal Power (MW)	2.0	2.0	2.0
Installed capacity (MW)	30	20	20
Manufacturer	VESTAS	VESTAS	VESTAS
Diameter (m)	100	100	100
Cut-in wind speed (m/s)	3	3	3
Cut-out wind speed (m/s)	20	20	20
Generators			
Nominal output (kW)	2,000	2,000	2,000
Quantity	15	10	10
Frequency (Hz)	60	60	60

The equipment and technology utilized in the proposed project activity has been applied to similar projects all over the world. Thus, no adverse effects to human health as well as the environment are expected from their installation.

Some components of the wind turbines, like the blades, are built locally. Therefore, thought not solely connected to the implementation of the project, it can be said that the expansion in the electricity generation by wind power plants, favors the local industry and contributes to the technology transfer to the Host Country.

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

The full implementation of proposed project activity will generate the estimated annual reductions as related in Table 3 below.

at http://www.aneel.gov.br/aplicacoes/editais_geracao/documentos/v.11-Edital%20A-3%20(18-07-2011)_final.pdf. A copy of the Public Announcement was also supplied to the DOE.

[5] Turbine information is available with the Project Participants and at Vestas' website: <http://www.vestas.com/en/wind-power-plants/procurement/turbine-overview/v100-2.0-mw-gridstreamer™-(iec-iia).aspx#/vestas-univers >.

Table 3 – Project Emissions Reductions Estimation

Years*	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1	133,800
Year 2	133,800
Year 3	133,800
Year 4	133,800
Year 5	133,800
Year 6	133,800
Year 7	133,800
Total estimated reductions (tonnes of CO_2e)	**936,600**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	133,800

**From March 01st to February 28th of the subsequent year*

A.4.5. Public funding of the project activity:

This project does not receive any public funding and it is not a diversion of ODA.

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).

- Tool to calculate the emission factor for an electricity system (version 2.2.1);
- Tool for the demonstration and assessment of additionality (version 06.0.0);
- 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 3.0.0).

The *Combined tool to identify the baseline scenario and demonstrate additionality* and the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* are not applicable to the project activity, and therefore are not used.

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

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

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

The proposed project activity consists of the implementation of a wind energy complex comprising three greenfield wind power plants corresponding to option a).

The methodology also provides the following conditions:

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

The proposed project activity is the installation of three new wind power plants.

- *In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of 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 the 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.*

  In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4W/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 $4W/m^2$;*
- *All reservoirs and hydro power 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 by 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 $4W/m^2$, is lower than 15MW;*
- *The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than $4W/m^2$, 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.

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

- *Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;*
- *Biomass fired power plants;*
- *A hydro power plant that result in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m2.*

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

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

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

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

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

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[6] 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.

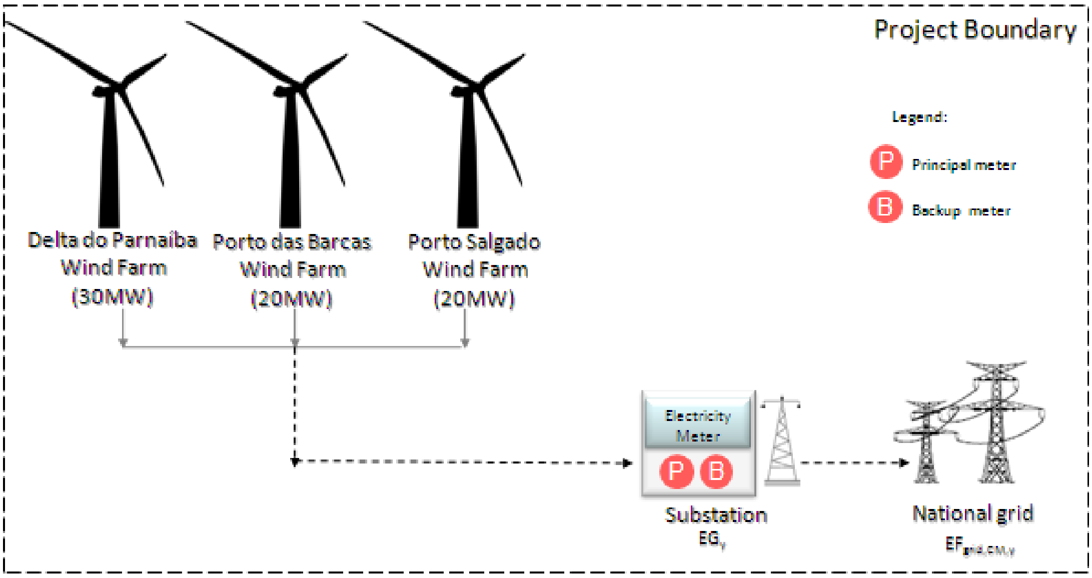

Figure 2 – Illustrative diagram of the Project boundary

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

Table 4 - 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.		

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

	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 is the installation of a new grid-connected renewable power plant/unit. Therefore, according 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):

The identified starting date of the proposed project activity is 02/05/2012, which represents the forecasted date when the Power Purchase Agreement is to be signed. For details on how the project starting date was identified please refer to Section C.1.1.

Considering that the PDD was published for Global Stakeholder Process (GSP) before this date, in accordance with the "*Guidelines in the demonstration and assessment of prior consideration of the CDM*" (Annex 22, EB49), no communication has to be made regarding CDM consideration, since the beginning of the GSP itself demonstrate that CDM is being considered.

Despite the recommendations of the Guidelines, to unequivocally demonstrate that the CDM was being seriously considered, Project Participants have forwarded the Prior Consideration of the CDM Form (F-CDM-Prior consideration) both for the Brazilian Designated National Authority and to the UNFCCC secretariat. The forms as well as the confirmation are available under request and were presented to the DOE validating the project.

The additionality of the proposed project activity will be assessed and demonstrated through the application of the "*Tool for the demonstration and assessment of additionality*". This tool provides 4 steps to determine whether the project activity is additional or not, which are further detailed below.

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

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

Ecopart Assessoria em Negócios Empresariais Ltda. is the CDM consultancy and does not invest in the construction and operation of Wind Power Plants. Also *Omega Energia Renovável S.A.* focuses in the development of electricity generation projects using alternative sources, as the company's portfolio is basically composed by small hydro power plants and wind power plants. In addition to this, the only possible resource to be used for electricity generation at the site where the plants are going to be located is the wind. Therefore, based on the nature of these two companies, namely the project participants, and the energy sources available at the site where the plants are going to be implemented, the only realistic alternatives to the project activity identified are:

Scenario 1: Continuation of the current (previous) situation of electricity supplied by the Brazilian Interconnected Grid.

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

Outcome: both scenarios identified above are realistic alternatives to the proposed project activity.

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

Both alternative scenarios identified above are in compliance with all regulations according the following entities: National Electric System Operator (ONS from the Portuguese *Operador Nacional do Sistema Elétrico*), Electricity Regulatory Agency (ANEEL from the Portuguese *Agência Nacional de Energia Elétrica*), Piauí State Environmental Agency (*SEMAR* - from the Portuguese *Secretaria de Meio Ambiente e Recursos Hídricos)* and the CDM Executive Board.

SATISFIED/PASS – Proceed to Step 2

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method:

Additionality is demonstrated through an investment benchmark analysis (option III). Options I and II are not applicable to the proposed project activity considering the following:

Option I – both the CDM 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 small hydro power plant projects - are not potential alternatives in the site where the project is planned.

In addition, in accordance with paragraph 19, Annex 5, EB62, the benchmark analysis was identified as the most appropriate method to demonstrate the additionality of the proposed CDM Project Activity since the alternative to the implementation of the wind power plants is the supply of electricity from the grid.

Sub-step 2b - Option III - benchmark analysis

The financial indicator identified for the project activity is the projects Internal Rate of Return (IRR) calculated in each wind power plant cash-flow. The IRR here presented for each plant is compared to the appropriate benchmark of the electric sector, which is the Weighted Average Cost of Capital (WACC).

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

The first significant commitment towards the implementation of the project is forecasted to happen in the beginning of 2012 (PPA). Thus, the starting date of the project activity is after the commencement of the validation, or rather, the investment decision has not been made yet. Therefore, the values used both in the IRR and WACC calculation are based on the most recent information available at the time the GSP of the project started – *i.e.* 2011. The rationale of the WACC and financial indicator calculations is presented below. The assumptions hereinafter described follow the guidance and rationale presented in the "*Guidelines on the assessment of investment analysis*" (version 05).

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 (in accordance with paragraph 12, Annex 5, EB62). 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 afterwards. Therefore, the use a sectoral benchmark is applicable as per the guidance provided in paragraph 13, Annex 5, EB62. The WACC is calculated through the formula below:

$$WACC = Wd \times Kd + We \times Ke, \text{ where:}$$

We and **Wd** are, respectively, the weights of equity and debt typically observed at the sector.

Usually, for alternative energy generating project, BNDES finances up to 80% of the items eligible for financing[7]. Considering the total investment necessary to build a plant, it can be assumed that approximately 70% of the project is financed. Therefore, the 70% percentage corresponds to the Initial Debt/Equity ratio for the energy generation companies, which is the portion disbursed by the bank to the investor and paid on the beginning of the project.

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

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

In general, the investor has a grace period before starting to pay the amortization and, at the same time, receives all the financing from BNDES on the beginning of the project. For the remaining time, the investor does not receive additional financing (debt proportion decreases), while investor starts to pay the amortization from the financing with his equity capital (equity proportion increases), increasing the ratio between Equity/Debt until there is no Debt in the 16th year of the BNDES funding period. This rationale is illustrated using a hypothetical example in the below figure.

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

Total Investment ($)	*500,000*
BNDES Tranche	*70%*
Amortization (years)	*16*
Inflation	*5%*

	Year 0	Year 1	Year 2	Year 3	...	Year 17	Year 18	Year 19	Year 20
Debt		350,000	0	0	...	0	0	0	0
Equity	150,000		21,875	21,875	...	21,875	0	0	0
Debt/Equity		70%	0%	0%	...	0%	0%	0%	0%
Equity/Debt		30%	100%	100%	...	100%	0%	0%	0%

Debt ($)	333,333
Equity ($)	387,076
Debt/Equity ratio	*46%*

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

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:

- Long Term Interest Rate (TJLP from the Portuguese *Taxa de Juros a Longo Prazo*) (**a**);
- BNDES remuneration (**b**);
- Credit risk rate (**c**).

TJLP (**a**) 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.

The BNDES remuneration (**b**) and the credit risk rate (**c**) are two other factors 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 mar-gin 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 the proposed project activity, the 0% tax factor applies. This method for calculating the corporate income tax and social contribution is called Presumed Profit. For the Presumed Profit eligibility, corporate entities revenues must be under forty eight million Reais per year (Article #13, Law #9.718/1998)[8].

The wind power plants cash flows are post-tax. Thus, they must be compared against a sectoral post-tax benchmark (Weighted Average Cost of Capital - WACC). The companies opting for the Presumed Profit System do not benefit from the cash and non-cash items deductions (as further detailed in the financial indicator calculation section below). Therefore, in the calculation for the cost of debt the marginal tax is zero. This results in a pre-tax WACC percentage equal to a post-tax WACC percentage, as follows:

Post-tax Rate = (Pre-tax Rate x (1 – Marginal Tax))

As a result, if marginal tax is 0 (zero) (Presumed Profit scheme), Post-tax rate is equal to Pre-tax rate. Thus, the post-tax Cost of Debt is added in the WACC calculation reaching a post tax WACC in accordance with the post-tax cash flow as recommended in paragraph 11 of Annex5, 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 using data and formulae presented in Table 5.

Table 5 – Cost of debt (Kd) calculation

Cost of Debt (Kd) = [1 + (a + b + c) x (1 - t)] / [(1 + π) -1]

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

(a) Financial cost[9]	6.53%
(b) BNDES remunaration[10]	0.90%
(c) Credit risk rate[11]	2.00%
(a+b+c) Pre-Cost of Debt	9.43%
(t) Marginal tax rate[12]	0%
(d) Inflation forecast[13]	4.50%
After tax Cost of Debt	4.71%p.a.

Cost of Equity (Ke)

Ke represents the rate of return for equity investments, estimated through the Capital Asset Pricing Model (CAPM). The CAPM is one of the most widely accepted models used to determine the required rate of return on equity. Then, as per option *b)* provided in the paragraph 15 of Annex5, EB62 , it was estimated using the best financial practices.

The CAPM calculates a newly introduced asset's non-diversifiable risk. CAPM takes into account the asset's sensitivity to non-diversifiable risk, better referred to as beta (**β**). Embedded in the model is also the market premium which can be tracked using historical data from the local or relevant equity market.

For the **Ke** calculation, the following parameters will be used:

– Risk-free rate (**Rf**);

– Equity risk premium (**Rm**);

– Estimated country risk premium (**Rc**);

– Adjusted industry beta (**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 treasury through spot TIPS (Treasury

9 http://www.bndes.gov.br/SiteBNDES/bndes/bndes_pt/Institucional/Apoio_Financeiro/Custos_Financeiros/Taxa_de_Juros_de_Longo_Prazo_TJLP/index.html
10 http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Galerias/Arquivos/conhecimento/bnset/Set2901.pdf
11 http://www.bndes.gov.br/SiteBNDES/export/sites/default/bndes_pt/Galerias/Arquivos/conhecimento/bnset/Set2901.pdf
12 http://www.receita.fazenda.gov.br/Aliquotas/ContribCsll/Aliquotas.htm http://www.receita.fazenda.gov.br/Aliquotas/ContribPj.htm
13 http://www.bcb.gov.br/pec/metas/InflationTargetingTable.pdf

Inflation Protected Securities) which are readily quoted in the market. There is no need to adjust for Brazil's expected inflation when dealing with a hurdle rate in real terms.

Beta, or **β,** stands for the average sensitivity of comparable companies in that industry to movements in the underlying market. **β** derives 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 there is 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 shall be used.

Considering explanation above, Ke is calculated using data and equation presented below in Table 6.

Table 6 – Cost of Equity (Ke) calculation

Cost of Equity (Ke) = [1 + (Rf + (β x Rm) + Rc)] x (1 + π) / (1+ π')-1	
(Rf) Risk-free rate[14]	4.25%
(Rm) Equity risk premium[15]	6.03%
(Rc) Estimated country risk premium[16]	2.45%
(β) Adjusted industry beta[17]	1.55%
(I) US expected inflation[18]	1.98%
Cost of Equity with Brazilian Country Risk (p.a.)	14.05%p.a.

Finally, plugging these numbers into WACC formulae:

WACC = 50% x 4.71% + 50% x 14.05% = 9.38%

[14] http://pages.stern.nyu.edu/~adamodar/
[15] http://pages.stern.nyu.edu/~adamodar/
[16] http://www.cbonds.info/all/eng/index/index_detail/group_id/1/
[17] http://pages.stern.nyu.edu/~adamodar/

Financial Indicator, Internal rate of return (IRR)

As mentioned above, the financial indicator identified for the Project Activity is the project Internal Rate of Return (IRR). The cash flow was calculated considering a period of 20 years (term of the PPA and expected technical lifetime of the plant). This term is also in line with the guidance of paragraph 3, Annex 5, EB62.

Besides, the income tax calculation also follows relevant guidance provided by Annex 5, EB62. In Brazil, there are two income taxes: (a) the corporate income tax (IRPJ) and (b) the social contribution tax on profits (CSLL) (see KPMG report "Investment in Brazil"[19]). There are also three methods provided by legislation to calculate corporate income tax and social contribution tax due on profits: Actual Profit, Presumed Profit and Arbitrated Profit.

Corporate entities are eligible to apply for the Presumed Profit if their revenues are under Forty eight million Reais per year (Article #13, Law #9.718/1998)[20].

For the Presumed Profit system, 8% of gross sales in addition to financial revenues/earnings are 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 are 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)[21].

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, depreciation and consequently fair value are not considered in the spreadsheet (paragraphs 4 and 5 of Annex 5, EB62).

The table presented below provides a summary of the main input values as well as a brief justification for their use. Documents evidencing all input values mentioned below which were used to estimate the IRR, were supplied to the DOE. Besides, the IRR calculation spreadsheet presenting all values and assumptions considered is also attached to this PDD.

Table 7 – Main inputs for the IRR calculation.

Parameter	Delta do Parnaiba Complex	Justification/source of information used
Installed Capacity	60	By the time the investment analysis was done, the technical

[18] http://www.federalreserve.gov/econresdata/researchdata.htm

[19] 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

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

[21] Publicly available in Portuguese at http://www.receita.fazenda.gov.br/legislacao/rir/L2Parte3.htm.

(MW)		configuration of the complex was under optimization. A preliminary study conducted by Garrad Hassan, issued on 16/08/2011, has shown that the final installed capacity is approximately 60MW. This preliminary study was used during the auction and was the most up-dated information previous to the start of the project's GSP. Copies of the preliminary results of the wind certification were supplied to the DOE. The final installed capacity of the complex was up-dated during the validation and its impact on the IRR of the project is assessed while conducting the sensitivity analysis.
Plant Load Factor (%)	55.8	Value estimated by the wind certification (Garrad Hassan) company at 50% of probability (P50). This range of probability represents 50:50 of chance of higher or lower generation of electricity by the plant. This is range is conservative. As an example, the financing institutions usually consider P90 for the financing agreement. The technical configuration of the complex is under optimization. The final plant load factor of the complex will be up-dated during the validation. Copies of the preliminary wind certification conducted by Garrad Hassan were supplied to the DOE.
PPA price (BRL/MWh)	104.76	The price of the PPA considered corresponds to the price obtained by the project's which negotiated their electricity in the energy auctions conducted by the Chamber for the Commercialization of Electric Power in 2011.The results of the auctions are publicly available at www.ccee.org.br. The average price was considered the annual revenues determined during the auction based on the amount of energy sold. The investment decision (signature of the PPA) is expected to occur in the beginning of 2012 (approximately one year after the auction). As per paragraph 6 of Annex 5, EB62, the tariff considered in the investment analysis (obtained during the auction) is valid and applicable, since this same value is going to be taken into account during the signature of the contracts. Moreover, the IRR calculation also considers revenues from the total electricity generated by the complex which exceeds the total negotiated during the auction (*i.e.* to be negotiated in the spot market). The price considered for the electricity to be sold to spot market is BRL116/MWh and was based in PSR estimations. PSR is a reputed company which provides consulting services in the area of electricity markets.

TUSD (BRL/kW/month)	100% of 3.13	In Brazil, electricity producers using renewable sources receive a 50% discount in the Tariff for the Use of the Distribution System - TUSD fee (from the Portuguese *Tarifa de Uso do Sistema de Distribuição*). 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[22] 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[23]. Therefore, the discount is not going to be taken into account. The value used is in accordance with the ANEEL Ordinance# 1.180, dated July 18th, 2011 and already considers the relevant taxes.
Corporate Income Tax and social contribution (BRL/year)	924,338	For the Presumed Profit system, 8% of the 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).
Investment (1,000 BRL)	253,460	Based on quotations from the manufacturers as well as from the EPC services providers. Electronic copies of the documents submitted to the DOE.
O&M costs(BRL/WTG.year)	115,000	Based on a quotation from the manufacturer.
TFSEE (BRL/kW.year)	385.7	The ANEEL Inspection Fee (from the Portuguese *Taxa de Fiscalização de Serviços de Energia Elétrica* - TFSEE) is an annual fee due by the holders of concessions, permissions or authorizations in the proportion of their dimension and activities. The value considered was set out by ANEEL Despatch #360, dated February 4th, 2011.
Project – IRR (%)	**5.37**	**Calculated in the attached spreadsheet.**

[22] 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).*
[23] Available in Portuguese at <http://www.aneel.gov.br/cedoc/ren2004077.pdf>. Accessed on 02/09/2011.

The IRR of wind power plant complex calculated using the assumption presented above shows that the IRR of the project without considering CERs revenues is lower than the WACC of the sector. Hence, it is evident that the project activity is not financially attractive to the investor. The result is summarized in Table 8 below.

Table 8 - Comparison between Project IRR and the Weighted Average Cost of Capital

	IRR (%)	WACC (%)
Delta do Parnaiba Complex	5.37	9.38

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

– Increase in electricity generation, which may increase the project revenues;

– Increase in electricity tariff, which may also influence project revenues;

– Reduction in expected investments

Those parameters were selected as being the most likely to fluctuate over time. In addition, these variables constitute more than 20% of either total project costs or total project revenues (paragraph 20 of Annex 5, EB62). Financial analyses were performed altering each of these parameters by 10%, and assessing what was the impact on project's IRR (paragraph 21 of Annex 5, EB62). The result is presented below in Table 9.

Table 9 – Sensitivity analysis (10% variation)

Scenario	IRR (%)
Increase in the tariff	6.85
Increase in electricity generation	6.97
Reduction in project investments	6.60

As can be observed from the results presented above, the project's IRR remains lower than the benchmark (9.38%) either increasing project revenues (electricity generation and tariff) or reducing project investments. Yet, a simulation was conducted in order to verify possible scenarios where the IRR would equal the benchmark. The results for each one of the wind power plants are presented in the tables below.

Table 10 – Scenarios when IRR of the project equals the benchmark (9.38%) – Delta do Parnaiba.

	IRR %	PRICE (BRL/MWh)	INVESTMENT (1,000BRL/MW)	ELECTRICITY (MWh/yr)	Variation (%)
Original	5.37	104.76	4,224	293,285	N/A
Price	9.38	134.77	4,224	293,285	28.65
Investment	9.38	104.76	3,056	293,285	-27.65
Electricity	9.38	104.76	4,224	371,005	26.50

The results presented above were achieved considering the plant load factor of the preliminary study conducted by Garrad Hassan, which was the most up-dated information available previously to the GSP. However, as mentioned earlier in this document, the Wind Power Plants' technical configuration was optimized. In this, the influence of this optimization also has to be assessed to confirm the project's adiditonality. Therefore, in addition to the analysis presented above, another simulation was conducted considering the final plant load factor based on the final wind certification issued in March 2012. The results are presented in the table below.

Table 11 –IRR variation considering the PLF presented in the final wind certification and the scenarios when it equals the benchmark (9.38%).

	IRR %	***PRICE*** ***(BRL/MWh)***	***INVESTMENT*** ***(1,000BRL/MW)***	***ELECTRICITY*** ***(MWh/yr)***	***Variation*** ***(%)***
Original	6.13	104.76	4,015	339,513	N/A
Price	9.38	128.33	4,015	339,513	22.50
Investment	9.38	104.76	3,096	339,513	22.90
Electricity	9.38	104.76	4,015	410,811	21.00

As it can be seen from the results presented above, even considering the optimized wind certification results, significant variations have to be observed in order the IRR of the project equals the benchmark. Nevertheless, it shall be noted that these variations in price, electricity and investment are not expected to occur as further substantiated below.

The electricity generation by the plants is not expected to rise because the estimative are based on the guaranteed power as measured at the plants' site by a third party at 50% of probability (P50). As explained previously this range means that there is a 50:50 chance of a higher or lower generation of electricity generation by the plant. At this range, more wind is captured indicating an optimistic estimative. For a reference, financing institutions consider wind measurements at 90% of probability (P90) as a conservative approach. Therefore, an increase in project revenues due to an increase in the electricity generation above the assumption presented in the cash-flow is very unlikely.

The price used in the analysis (BRL104.76/MWh) was taken from the results of the 2011 public auctions conducted by the Chamber of Electrical Energy Commercialization (CCEE – *Câmara de Comercialização de Energia Elétrica*). The electricity to be dispatched to the grid by the plants was negotiated during this auction. According to CCEE *the criterion of the least tariff is used to define the winners of a given auction, that is, the winners of the auction shall be those bidders which offer electric power for the least price per Mega-Watt Hour to supply the demand envisaged by the Distributors*. The sensitivity analysis also took into account the variation in the price of electricity to be sold to the spot market. For the complete results please refer to the attached spreadsheet.

The result of a successful participation in this kind of public auction is the signature of a Power Purchase Agreement called CCEAR – Contract on Energy Commercialization in Regulated Market[24]. CCEAR's will

[24] According to CCEE *the new model for the electric sector states that the commercialization of electric power is accomplished in two market ambiences: the Regulated Contracting Ambience – ACR (Ambiente de Contratação Regulada) and the Free Contracting Ambience –ACL (Ambiente de Contratação Livre). Contracting in the ACR is formalized by means of regulated, bilateral agreements, called Electric Power Commercialization Agreements within the Regulated Ambience (CCEAR – Contratos de Comercialização de Energia Elétrica no Ambiente Regulado) entered into between Selling Agents (sellers, generators, independent producers or self-producers) and Purchasing Agents (distributors) which participate of electric power purchase and sale auctions.*

remain fixed throughout the years, and will only be adjusted accordingly to the Amplified Consumers Price Index (from the Portuguese *Índice de Preços ao Consumidor Amipliado*), which is the official index that measures the inflation in Brazil. However, the cash flow was done without considering any variation due to inflation over the considered years. Hence, no variation in the project IRR can be expected to be associated to a possible increase in the price of electricity.

The total investment necessary to build the plants as it is presented in the cash flow corresponds to the estimated investment cost made by the project owner. Specifically for this project activity the project owner is planning to sign an EPC contract. This type of contract fixes the price to build a plant and any variation either in favor or against the project is in charge of the construction company which means that no variation in project IRR can be attributed to a variation in the investment costs.

Outcome

The IRR of the project activity without being registered as a CDM project is significantly below the sector benchmark, evidencing that project activity is not financially attractive to investor. Then, scenario 1 would be the most plausible alternative to the project activity, *i.e.* the continuation of the current situation with additional electricity supplied by the Brazilian Interconnected Grid.

SATISFIED/PASS – Proceed to Step 3

Step 3. Barrier analysis

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity

Not applicable. Step 2 was applied in order to determine project’s additionality.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives:

Not applicable. Step 2 was used to determine project’s additionality.

SATISFIED/PASS – Proceed to Step 4

Step 4. Common practice analysis

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

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

Based on the definition presented above, the tool provides a stepwise approach to be applied while conducting the common practice in order to identify similar projects to the proposed CDM Project Activity. Furthermore, the tool establishes that this approach shall be used if the proposed CDM Project Activity complies with one of the measures listed 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.

Delta do Parnaíba Wind Power Plant Complex CDM Project Activity matches option (b) since it consists of a switch from grid electricity to electricity generation from wind power plants[25]. Therefore, only wind power plants were considered in this common practice analysis.

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

The three wind power plants considered in this CDM Project Activity sum 70 MW of installed capacity. Taking into account the above range, the common practice analysis will be conducted considering projects possessing and installed capacity between 35MW and 105MW.

***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 shall not be included in this step;*

As per the guidance of step 2, the plants considered in the analysis were selected following the definitions for output and geographical area as presented in the additionality tool.

(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 project, the output considered is the renewable electricity generated by grid-connected wind power plants.

(ii) Applicable geographical area

The additionality tool states:

[25] Analogously to the example provided in the Annex 8 of the EB 62.

"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 applied in the project is not country specific. Nevertheless, Brazil has an extension of 8,514,876.599km^2 (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 wind power plants implementation since meteorological events have strong influence in the wind regime. As cited by VESELKA[26], the *climate affects all major aspects of the electric power sector from electricity generation, transmission and distribution system to consume demand for power*. Therefore, it is reasonable to assume that the technology may vary considerably from location to location within the country.

According to the Brazilian Electricity Regulatory Agency all regions of the country have some potential to generate electricity using wind. From Figure 4 it can be observed that the highest wind power potential is located in the northeast region of the country, where the majority of operational projects are located.

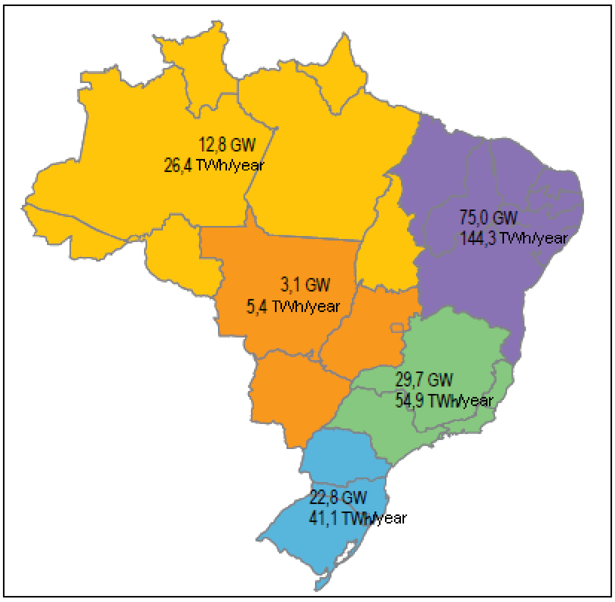

Figure 4: Brazilian wind resource potential[27].

The Brazilian Wind Energy Atlas[28], sponsored by several governmental entities in 2001 presents climatic information which influences the wind formation, and as a consequence, impacts the wind power potential of

[26] 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>.
[27] 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>.

a given region. Based on the topography of the region, wind speed and direction, and air temperature, the study presents the potential wind energy generation of the country by region and season (some examples are provided below in Figure 5).

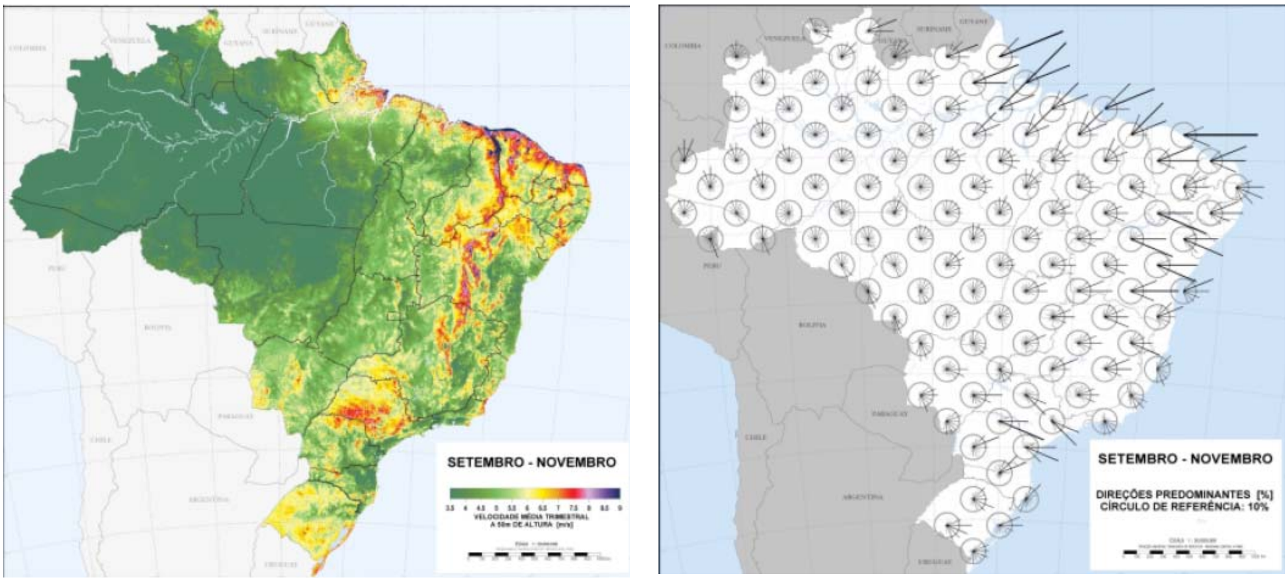

Figure 5 - Wind speed map on the left and Direction and intensity of wind map on the right. Source: Atlas do Potencial Eólico Brasileiro[28], 2001.

As it can be observed in the results of this report, due its vast territory, several different climatic conditions are registered within the country which clearly distinguishes the regions regarding their wind energy potential. In addition to report, several other initiatives related to exploring the wind energy potential in Brazil were performed. One of them, in which Camargo Schubert – a reputed wind certification - collaborated with, was the elaboration of Wind Energy Atlas at the state level.

Three different Wind Energy Atlas of Bahia, Rio Grande do Norte and Alagoas were assessed. These states are all located in the northeastern region of the country, which is also the region with the highest wind potential and where the proposed CDM Project Activity is located. The final results presented in the reports show that the most favorable location for wind power plants implementation varies between these states. While in Bahia and Alagoas states the highest wind potentials ate located in the interior of the state, the Rio Grande do Norte state has its highest wind power potential located next to the coast (Figure 6, Figure 7, and Figure 8, respectively). These conditions have influence in the investment decision since, in general, project located by the coast have an easier logistics for wind power projects.

[28] CRESESB - Centro de Referência para Energia Solar e Eólica Sérgio Brito. **Atlas do Potencial Eólico Brasileiro**. Brasília: 2001. Publicly available at <http://www.cresesb.cepel.br/publicacoes/index.php?task=livro&cid=1>. Accessed on March 15th, 2012.

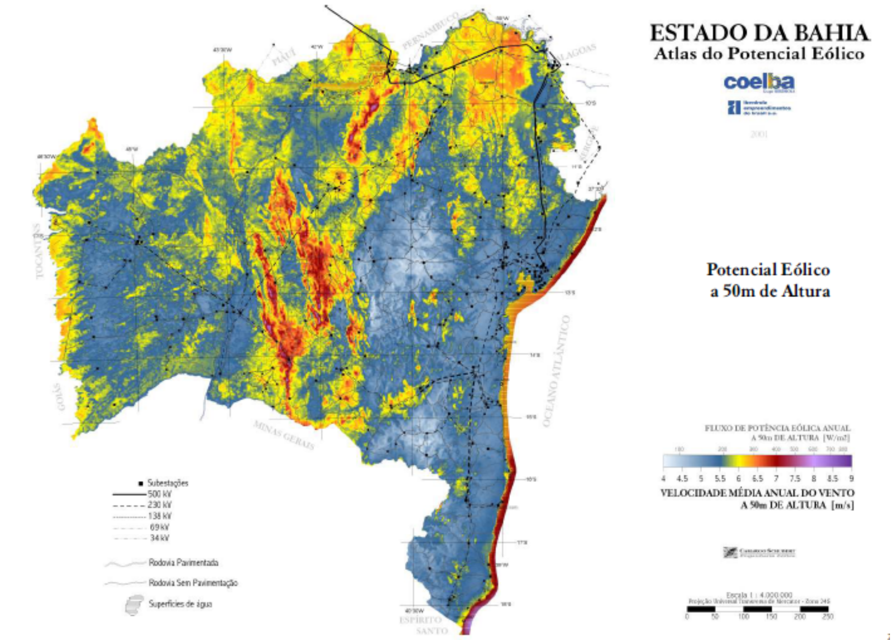

Figure 6 – Bahia State wind power potential. Source: COELBA - Bahia Wind Energy Atlas.

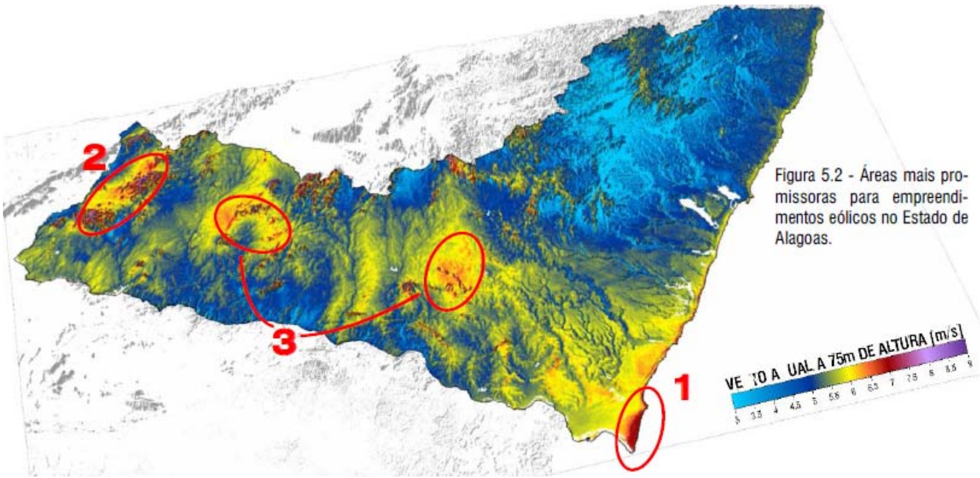

Figure 7- Alagoas wind power potencial. Source: Eletrobrás – Alagoas Wind Energy Atlas.

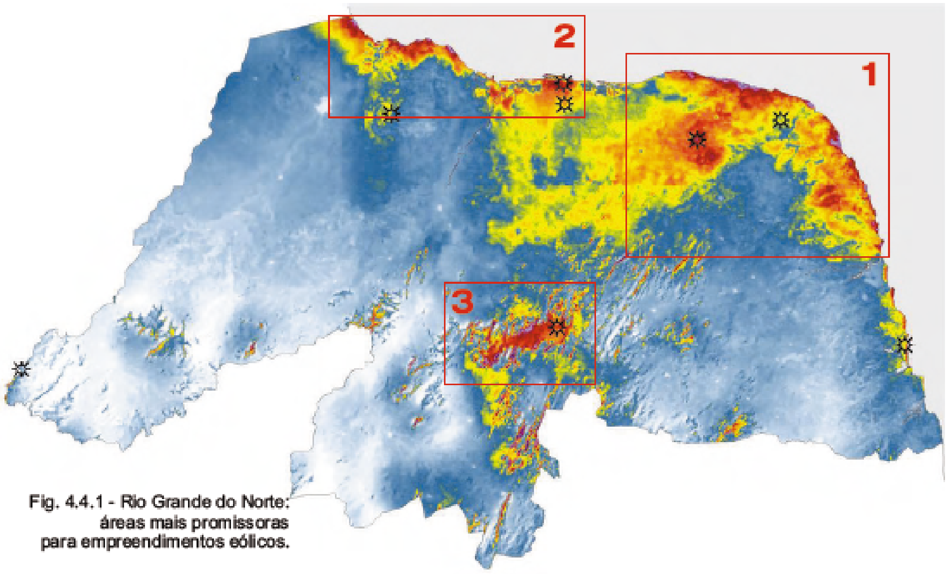

Figure 8 - Rio Grande do Norte wind power potencial. Source: COSERN – Rio Grande do Norte Wind Energy Atlas.

Nevertheless, the climate conditions are not the only distinguishing feature among the several regions of the country. In Brazil, project developers connecting to the transmission or distribution network are charged a fee called Tariff for the Use of the Transmission/Distribution System. This tariff varies depending on the state where the power plant is connected to. TUST/TUSD is established by specific ANEEL regulation and has strong impact in the financial analysis of a project. Just for reference, for the second semester of 2011 until the first semester of 2012, TUSD in Rio Grande do Norte state (located in the same region of Piauí) was BRL 3.51/kW[29] and BRL 7.40/kW in Piauí[30] state (more than two times bigger than Rio Grande do Norte).

In addition, it is worth mentioning that each state has a specific environmental agency responsible for determining the technical standards required to obtain all environmental licenses, with regional regulations and distinct administrative process established by each state region. On June, 2009, the Brazilian Secretariat of Climate Change and Environmental Quality conducted a study to evaluate the procedures set out by each environmental agency of the states regarding the wind power plants environmental licensing process[31]. The result of this study clearly demonstrates that each environmental agency has a different requirement and procedures in order to issue the environmental licenses for wind power plants.

Therefore, when evaluating the different climate conditions of each region, the specific environmental regulatory framework of each state, the energy price subdivision per markets and different values of TUSD/TUST applied at each Brazilian state, it's clear that the national territory does not consist of the same "comparable environments" as required by the methodological tool "*Demonstration and assessment of additionality*". Undoubtedly, these differences among the Brazilian states (climate, energy price,

[29] ANEEL Resolution nr. 1139 issued on April 19th 2011. Available at: http://www.aneel.gov.br/cedoc/reh20111139.pdf
[30] ANEEL Resolution nr. 1195 issued on August 23th, 2011. Available at: http://www.aneel.gov.br/cedoc/reh20111195.pdf
[31] SMCQ - Secretaria de Mudanças Climáticas e Qualidade Ambiental. **Pesquisa sobre licenciamento ambiental de parques eólicos.** Publicly available in Portuguese at <http://www.protocolodemontreal.org.br/eficiente/sites/protocolodemontreal.org.br/pt-br/site.php?secao=publicacoes&pub=240>, Accessed on March 14th, 2012.

transmission/distribution costs and environmental legislation) have technical, financial and regulatory impacts for the implementation of wind power plants.

Considering the definitions presented above, only electricity generated by grid-connected wind power plants between the ranges established in step 1 above in Piauí state were considered in this analysis. Other CDM Project Activities, defined by the tool as the ones *registered (...)* and that *have been published on the UNFCCC website for global stakeholder consultation as part of the validation process* were not taking into consideration.

In addition, the starting date of the project activity is after the commencement of the validation. Therefore, only plants that became operational before the proposed CDM project activity was published for GSP (November 15th, 2011) were considered.

A list of all plants considered in the analysis was supplied to the DOE. The result of N_{all} for each range identified above in step 1 (35MW – 105MW), is that there is no operational wind power plant with an installed capacity between the identified range. Therefore, $\mathbf{N_{all} = 0}$.

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}.

As discussed above in *Step 2*, no similar wind power plant located in Piauí was identified. Hence, $\mathbf{N_{diff} = 0}$.

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.*

From the results discussed above, we have:

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

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

Therefore, *Delta do Parnaíba Wind Power Plant Complex CDM Project Activity* is not a common practice.

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

Amongst the operational plants in the country, wind power project represent only 0.94% (Figure 9).

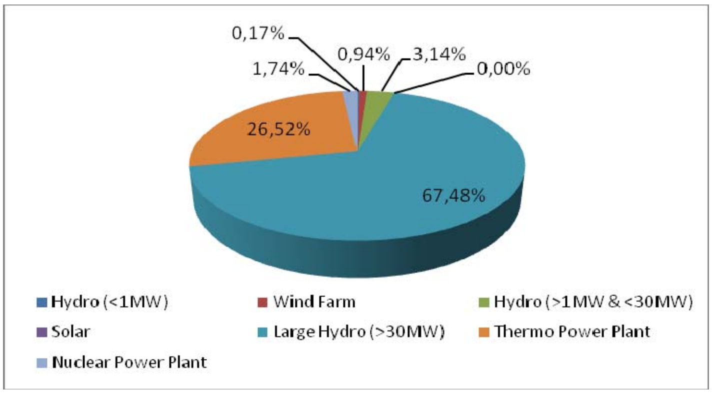

Figure 9 – Brazilian electricity matrix as of April 2011 (Source*:* ANEEL, (2011)[32])

In summary, the proposed CDM Project Activity cannot be considered common practice and therefore is not a business as usual type scenario. And it is clear that, in the absence of the incentive created by the CDM this project would not be the most attractive scenario.

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).

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);

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[32] ANEEL (2010). Banco de Informações de Geração - BIG. Capacidade de Geração. http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp. Accessed on 26 April 2011.

$EG_{PJ,y}$ = 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 to the baseline calculation 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*".

Brazilian DNA published Resolution #8, issued on 26th May, 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).

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.

The Brazilian DNA made available the operating margin emission factor calculated using option *(c) Dispatch data analysis OM*. Detailed information on the methods and data applied can be obtained in the DNA's website (http://www.mct.gov.br/index.php/content/view/317399.html#ancora).

In accordance with the tool, for the dispatch data analysis, the emission factor shall be up-dated annually, i.e. the *ex-post* data vintage is chosen.

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

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

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

Where:

$EF_{grid,OM-DD,y}$ = Dispatch data analysis operating margin CO_2 emission factor in year *y* (tCO_2/MWh);

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

$EF_{EL,DD,h}$ = CO_2 emission factor for power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh);

$EG_{PJ,y}$ = Total electricity displaced by the project activity in year *y* (MWh);

h = Hours in year *y* in which the project activity is displacing grid electricity;

y = Year in which the project activity is displacing grid electricity.

Calculation of hourly CO_2 emission factor for grid power units ($EF_{EL,DD,h}$)

The Brazilian DNA made available the calculation of the operating margin emission factor based on option *(c) dispatch data analysis*. Therefore, the project participants used this figure for the proposed project activity.

However, the project participants neither have access to the decisions that the Brazilian DNA took in order to calculate the hourly CO_2 emission factor nor to the spreadsheet used. Only final values are available for public consultation. Hence, the project participants are not able to describe which method has been used to calculate the hourly emission factor.

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

The Brazilian DNA made available the calculation of the operating margin emission factor based on option *(c) dispatch data analysis*. Therefore, the project participants used this figure for proposed project activity.

However, the project participants neither have access to the decisions that the Brazilian DNA took in order to determine the set of power units n nor to the spreadsheet used. Only final values for the hourly emission factor ($EF_{EL,DD,h}$) are available for public consultation. Hence, the project participants are not able to describe which method has been used to determine the set of power units n.

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

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

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

Where:

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

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

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

m = Power units included in the build margin;

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

Calculation to determine the set of power units m included in the build margin

The Brazilian DNA made available the calculation of the build margin emission. Therefore, the project participants used this figure for proposed project activity.

However, the project participants neither have access to the decisions that the Brazilian DNA took in order to determine the set of power units *m* nor to the spreadsheet used. Only final values are available for public consultation. Hence, the project participants are not able to describe which method has been used to determine the set of power units *m*.

Calculation of the CO_2 emission factor for each power unit m ($EF_{EL,m,y}$)

The Brazilian DNA made available the calculation of the build margin emission. Therefore, the project participants used this figure for proposed project activity.

However, the project participants neither have access to the decisions that the Brazilian DNA took in order to calculate the CO_2 emission factor for each power unit *m* nor to the spreadsheet used. Only final values are available for public consultation. Hence, the project participants are not able to describe which method has been used to calculate the CO_2 emission factor for each power unit *m*.

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

The combined margin calculation is based on method a provided by the tool, 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.

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 as project emissions 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 water 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 for emissions from the consumption of fossil fuels. Therefore, in the case of the proposed project activity, $PE_{FF,y}$ = 0tCO_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 of the construction of a wind power plant, there are no emissions related to non-condensable gases from the operation of geothermal power plants. Therefore, $PE_{GP,y}$ = 0tCO_2.

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, $PE_{HP,y}$ = 0tCO_2.

Leakage calculation (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 of the proposed project activity is 0tCO_2.

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

All parameters used for the determination of the emission reductions by the proposed project activity are monitored. For details please refer to section B.7.1. below.

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

Baseline emissions (BE_y)

The quantity of net electricity generation supplied by the wind power plants to the grid in year *y* ($EG_{faciclity,y}$, in MWh) was based on the results presented in the Wind Certification conducted by Garrad Hassan (in line with option *b)*, paragraph 3, Annex 11, EB 48). In total, the three Wind Power Plants considered in this CDM Project Activity will generate 339,513MWh to be dispatched into the grid every year. The result for each of the plants is presented below in Table 12.

Table 12 – Net electricity generation by the wind plants of the CDM Project Activity, as of March 2012.

Wind Power Plant	Net electricity generation (MWh)

Delta do Parnaíba	148,622
Porto das Barcas	98,636
Porto Salgado	92,255
Total	**339,513**

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.

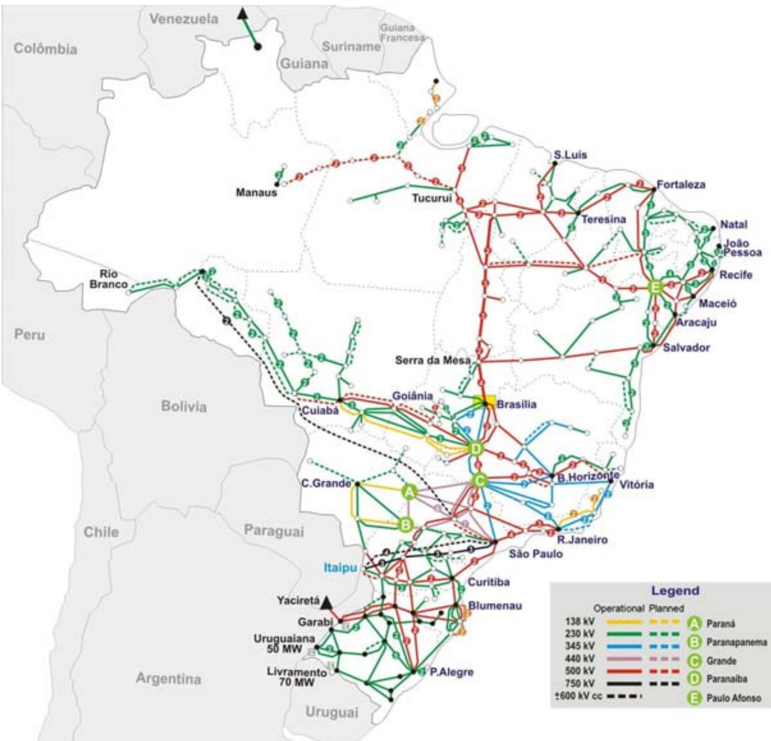

Figure 10 – Brazilian Interconnected System. (*Source:* Electric System National Operator)

- **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 Brazilian DNA made publicly available the OM through the dispatch data analysis OM (option c). Therefore, this method was used for the proposed project activity. Please refer to section B.6.1. for the proper justification.

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

The Brazilian DNA made publicly available the OM emission factor through the dispatch data analysis OM (option c). For the purpose of estimative, the average of the monthly data from 2010 was used (the most recent data available at the validation commencement). The result is presented below.

$EF_{grid,OM\text{-}adj,y} = 0.4787\ tCO_2e/MWh$

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

The Brazilian DNA made publicly available the OM emission factor through the dispatch data analysis OM (option c). For the purpose of estimative, the average of the monthly data from 2010 was used (the most recent data available at the validation commencement).The result for the build margin emission factor is presented below.

$EF_{grid,BM,y} = 0.1404\ tCO_2e/MWh$

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

Applying the results presented above in STEPS 4 and 6 above to the Equation 6 presented in section B.6.1. and considering the weights $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (as per method ***a)*** of the tool) we obtain,

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

$EF_y = 0.75 \times 0.4787 + 0.25 \times 0.1404$

$EF_{grid,CM,y} = 0.3941\ tCO_2e/MWh$

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

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

$EG_{PJ,y} = EG_{facility,y}$ = 339,513MWh

BE_y = 339,513MWh x 0.3941tCO_2/MWh

BE_y = 133,800tCO_2

Project Emissions (PE_y)

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

PE_y = 0tCO_2

Leakage emissions (LE_y)

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

LE_y = 0tCO_2.

Emission reductions (ER_y)

Applying the results discussed above to Equation 1 we obtain,

$ER_y = BE_y - PE_y$

ER_y = 133,800tCO_2

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

Table 13 – Summary of the ex-ante estimation of emission reductions

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	0	133,800	0	133,800
Year 2	0	133,800	0	133,800
Year 3	0	133,800	0	133,800
Year 4	0	133,800	0	133,800
Year 5	0	133,800	0	133,800
Year 6	0	133,800	0	133,800
Year 7	0	133,800	0	133,800
Total (tonnes of CO_2e)	**0**	**936,600**	**0**	**936,600**

**From March 01st until February 28th*

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
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*.
Source of data to be used:	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	Delta do Parnaíba – 148,622

for the purpose of calculating expected emission reductions in section B.5	
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. Information will be continuously monitored and monthly recorded, at least.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipment used have, by legal requirements, an 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 above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*.
Source of data to be used:	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	Porto das Barcas – 98,636
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. Information will be continuously monitored and monthly recorded, at least.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipment used have, by legal requirements, an 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 above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*.
Source of data to be used:	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	Porto Salgado – 92,255

emission reductions in section B.5	
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. Information will be continuously monitored and monthly recorded, at least.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipment used have, by legal requirements, an 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 above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

Data / Parameter:	$EG_{PJ,h}$
Data unit:	MWh
Description:	Electricity displaced by the project activity in hour *h* of the year *y*
Source of data to be used:	Local measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not used for ex-ante estimative
Description of measurement methods and procedures to be applied:	The electricity delivered to the grid by the project activity is monitored by the project owner. Hourly aggregated information will be used to determine the operating margin CO_2 emission factor following the steps provided in the "*Tool to calculate the emission factor for an electricity system*".
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). Hourly information provided by project participants can be weekly aggregated and crosschecked with the Reports issued by CCEE.
Any comment:	-

Data / Parameter:	$EF_{EL,DD,h}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for power units in the top of the dispatch order in hour *h* in year *y*
Source of data to be used:	Brazilian DNA website (http://www.mct.gov.br/index.php/content/view/317399.html#ancora)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Large amount of data.
Description of measurement methods and procedures to be applied:	The selected option to calculate the operating margin is the dispatch analysis which does not permit the vintage of *ex-ante* calculation of the emission factor. Hence, this value will be calculated annually applying the numbers published by the Brazilian DNA and following the steps provided in the "*Tool to calculate the emission factor for an electricity system*".

QA/QC procedures to be applied:	Official source of information (*i.e.* Brazilian DNA) will be used.
Any comment:	For the purpose of estimative, the operating margin was determined considering the average of the monthly operating emission factor published by the DNA.

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor in year *y*
Source of data to be used:	Brazilian DNA website (http://www.mct.gov.br/index.php/content/view/317399.html#ancora)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.1404
Description of measurement methods and procedures to be applied:	The selected option to calculate the operating margin was the dispatch analysis which does not permit the vintage of *ex-ante* calculation of the emission factor. Hence, this value will be calculated annually applying the numbers published by the Brazilian DNA and following the steps provided in the "*Tool to calculate the emission factor for an electricity system*".
QA/QC procedures to be applied:	Official source of information (*i.e.* Brazilian DNA) will be used.
Any comment:	For the purpose of the emission reductions estimation 2010 data was used. This was the most recent publicly available information at the time the validation of the proposed project activity started.

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "*Tool to calculate the emission factor for an electricity system*"
Source of data to be used:	Brazilian DNA website (http://www.mct.gov.br/index.php/content/view/317399.html#ancora)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined in each CPA.
Description of measurement methods and procedures to be applied:	The selected option to calculate the operating margin was the dispatch analysis which does not permit the vintage of *ex-ante* calculation of the emission factor. Hence, this value will be calculated annually applying the numbers published by the Brazilian DNA and following the steps provided in the "*Tool to calculate the emission factor for an electricity system*".
QA/QC procedures to be applied:	Official source of information (*i.e.* Brazilian DNA) will be used.
Any comment:	-

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 (NIPS) under supervision and regulation of ANEEL[33] 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[34]. 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[35].

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[36]. In addition, ONS also rules about the electricity meter calibration requirements (every two years)[37].

There will be two energy meters (principal and backup) for each wind power plant located at the substation that they are going to be connected to, as specified by CCEE[38]. 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 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)

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[33] Information available at <http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en>.
[34] Information available at <http://www.aneel.gov.br/>.
[35] Information available at <http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=25afa5c1de88a010VgnVCM100000aa01a8c0RCRD>.
[36] 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.
[37] 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.
[38] Meters requirements are available at ONS' website: <http://www.ons.org.br/download/procedimentos/modulos/Modulo_12/Submodulo%2012.2_Rev_1.0.pdf>.
Models of meters that have the technical characteristics as required by ONS, available at CCEE's website: <http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=ca4da5c1de88a010VgnVCM100000aa01a8c0RCRD>.

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 farms - OMEGA ENERGIA RENOVÁVEL S.A. - 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 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 plants 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 plants, indicating the mitigation measures to be adopted during the construction phase. These measures are being taken rigorously. Data regarding the environmental impact is being archived by the wind power plants and the environmental agencies.

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

The emission factor of the grid will be determined as per the requirements of the "*Tool to calculate the emission factor for an electricity system*" and official data published by the Brazilian DNA is to be used for its calculation. Yet, in line with the CDM requirements, all data used to monitor the emission reductions by the proposed project activity will be kept for at least 2 years after the end of the last crediting period.

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 final draft of this baseline section and the monitoring methodology (DD/MM/YYYY): 25/02/2011.

Name of person/entity determining the baseline:

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Ecopart Assessoria em Negócios Empresariais Ltda. is also a Project Participant listed in Annex 1.

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:

(DD/MM/YYYY) 02/05/2012

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

Considering the above information, in order to determine project activity's starting date the forecasted date for the following events were considered: **financing agreement, Power Purchase Agreement, major equipment orders and start of construction**. None of these events have yet taken place. However they are forecasted to happen as follows:

- **Financing agreement:** Not signed yet.
- **Power Purchase Agreement:** Not signed yet. In accordance with the auction schedule, the PPA is forecasted to be signed on May 2nd, 2012
- **Major equipment orders:** No agreement between the project sponsor and equipment suppliers has been made yet.
- **Start of construction:** It is estimated that the construction of the wind power plants start approximately one year before the estimated date for the beginning of the plant's operations, in February 2012.

From the above, the identified starting date of the proposed project activity is forecasted to be on 02/05/2012.

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

20 years, 0 months.

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

The proposed project activity will use a renewable crediting period.

C.2.1. Renewable crediting period:

Each crediting period shall be at most 7 years and may be renewed at most two times.

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

(DD/MM/YYYY) 01/03/2013

C.2.1.2. Length of the first crediting period:

7 years, 0 months.

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 activity capable of causing environmental degradation is obliged to secure several permits from the relevant environmental agency (federal and/or local, depending on the project).

The environmental impact of Wind Power Plants as the ones considered in the proposed project activity is considered small given the other sources of electricity generation. For this reason, in accordance with the National Environment Council (from the Portuguese CONAMA - *Conselho Nacional do Meio Ambiente*) Resolution #279, dated 27/06/2001[39], wind power plants must do a simplified environmental impact assessment in order to obtain the necessary licenses to the project.

Licenses required by the Brazilian environmental law (National Environmental Council Resolution – from the Portuguese CONAMA - *Conselho Nacional do Meio Ambiente* nr. 237/97[40]) 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).

[39]Available at: http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=277
[40] Available at: http://www.mma.gov.br/port/ conama/res/res97/res23797.html.

The process starts with a previous analysis (preliminary studies) by the local environmental department. In turn, 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 local environmental agency positive understanding regarding the environmental project concepts.

In order to obtain the Construction License (LI) it is necessary to present (a) additional information related to the 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 demands made by environmental local agency were completed.

The plants which are going to originate the complex are individually analyzed by the Piauí Environmental Agency (*SEMAR- Secretaria de Meio Ambiente e Recursos Hídricos*). Delta do Parnaíba and Porto das Barcas already possess the Construction License. Porto Salgado has the Preliminary License already issued. Information of these permit are presented below.

Table 14 – Delta do Parnaíba Wind Power Plant Complex environmental permits.

Wind Power Plant	License #	Issued by	Issuance Date	Valid trough
Delta do Parnaíba	D000365/11	SEMAR	12/05/2011	12/05/2012
Porto das Barcas	D000363/11	SEMAR	12/05/2011	12/05/2012
Porto Salgado	D000476/11	SEMAR	16/06/2011	16/06/2012

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, wind power plants have to do a simplified environmental impact assessment in order to obtain the necessary licenses to the project. The simplified environmental impact assessment developed specifically to the Wind Power Plants considered in this CDM Project Activity evaluated the possible impacts occurring during two different phases of the project implementation: construction and operation. The impacts were also classified according to its effect (positive or negative), duration (short term or long term), scope (local or regional), reversibility (reversible or not). Depending of the identified impact, mitigation measures were proposed.

Negatives impacts are mostly expected to occur during the implementation phase and are related to influences in the soil, air quality, and vegetation. Examples of these impacts are the increase in the particulate matter production due to the construction, noise, fauna disturbances and erosion. However, the duration of these impacts is short (only while the project is being constructed) and the majority of them are fully reversible.

Irreversible negative impacts are expected to occur during the operation of the plant and are connected to the landscape modification, interferences on birds (collision, habitat disturbances, among others) and cultural influence in local communities. However, mitigation measures were proposed to decrease magnitude of these impacts and are all contemplated in the wind power plants' environmental monitoring plan.

Positive impacts are mostly expected to be observed in the socio-economic field. The implementation of wind farms commonly increases job opportunities and municipal income trough the payment of royalties. In contrast with the negative aspects, these impacts are forecasted to occur in the operational phase of the project, have a long duration and a regional influence.

Project sponsor has already presented the environmental assessment to the local environmental agency while requesting the preliminary environmental permit. 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:

According to Resolution nr. 7, issued on March 5th 2008[41], Brazilian Designated National Authority (*Comissão Interministerial de Mudanças Globais do Clima – CIMGC)*, requests, among other documents, comments from local stakeholders in order to provide the Letter of Approval for a project.

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

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

The same resolution also requires that at the time these letters are sent, a version of the PDD in the local language and a declaration stating how the project contributes to the sustainable development of the country must be made available to these stakeholders at least 15 days previous to the starting of the Global Stakeholder Process (GSP). The Portuguese version of the PDD was published at the internet website <http://sites.google.com/site/consultadcp/> on 26/10/2011 which is also the date when the invitation letters were sent to the following agents:

– *Prefeitura de Parnaíba* (Parnaíba City Hall)

[41] Available at: <http://www.mct.gov.br/>.

- *Câmara Municipal de Parnaíba* (Municipal Assembly of Parnaíba)
- *Secretaria do Meio Ambiente de Parnaíba* (Environmental Agency of Parnaíba)
- *Associação de Parnaíba* (Comunity Association of Parnaíba)
- *Secretaria de Meio Ambiente e Recursos Naturais do Estado do Piauí - SEMAR* (Piauí Environmental Agency)
- *Ministério Público Federal* (State Attorneys for the Public Interest of Brazil)
- *Ministério Público do Piauí* (State Attorneys for the Public Interest of Piauí state)
- *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)

Up to date no concerns have been raised in the public invitations regarding the project.

E.2. Summary of the comments received:

No comments have been received yet.

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

No comments have been received yet.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

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

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Annex 3

BASELINE INFORMATION

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

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Annex 4

MONITORING INFORMATION

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

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