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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Title of the project activity: *Lagoa de Touros Wind Power Plants CDM Project Activity*.

Version number of the document: 04

Date (DD/MM/YYYY): 13/04/2012

A.2. Description of the project activity:

The primary objective of the seven 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 seven wind power plants comprising 177.8 MW of installed capacity, as follows: Lagoas de Touros 1, 2, 4, 6 and 7 Wind Power Plants (28.8 MW), Lagoa de Touros 3 Wind Power Plant (16.2 MW) and Lagoas de Touros 5 Wind Power Plant (17.6 MW). These seven plants are expected to become operational in August, 2014 and are all located in the Touros municipality, Rio Grande do Norte 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 owner of the plants is Zeta Energia S.A. Zeta is a company which prospects renewable energy projects, focusing on wind energy.

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
	Zeta Energia S.A. (private entity)	
	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.:

Rio Grande do Norte

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

Touros and Rio do Fogo municipalities

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 each site are presented in the table below.

Table 2: Project activity geographic coordinates.

Geographic Coordinates	*Longitude (West)*	*Latitude (South)*
Lagoas de Touros 1	-35.4252	-5.3002
Lagoas de Touros 2	-35.3612	-5.3100

Lagoas de Touros 3	-35.4444	-5.3145
Lagoas de Touros 4	-35.4176	-5.3122
Lagoas de Touros 5	-35.4421	-5.3359
Lagoas de Touros 6	-35.4580	-5.3569
Lagoas de Touros 7	-35.5318	-5.3301

†Note: The geographic coordinates here presented are the ones corresponding to the location of the first aerogenerator of each power plant, as described in the Wind Certificate.

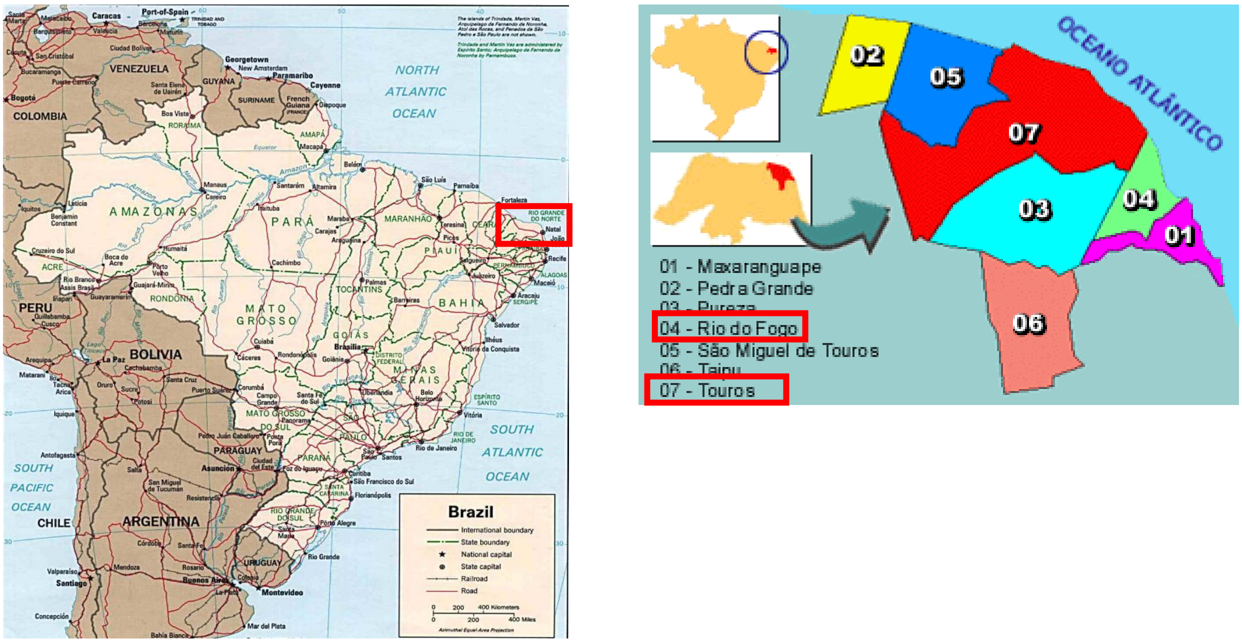

Figure 1: Rio Grande do Norte state (on the left) and Touros municipality (#7) on the right.

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 construction of seven wind power plants summing 177.8MW 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 technology to be employed by each of the sites considered in this project activity is described below in Table 3.

Table 3 Project technical description, as of January 2012 (*Source:* Vestas' manual[4] and GE's manual[5]).

Wind Power Plant	***Lagoas de Touros 1 and 2***	***Lagoa de Touros 4, 6 and 7***	***Lagoas de Touros 3***	***Lagoas de Touros 5***
Turbines				
Model	V100 – 1.8MW	GE sle 1.6MW	V100 – 1.8MW	GE sle 1.6MW
Quantity	16	18	9	11
Nominal Power (MW)	1.8	1.6	1.8	1.6
Installed capacity (MW)	28.8	28.8	16.2	17.6
Manufacturer	VESTAS	GE	VESTAS	GE
Diameter (m)	95	80	95	80
Generators				
Type	Asynchronous	Asynchronous	Asynchronous	Asynchronous
Nominal output (kW)	1,800	1,600	1,800	1,600
Quantity	16	18	9	11
Frequency (Hz)	60	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.

4 Turbine information is available at Vestas' website <http://www.vestas.com/en/wind-power-plants/procurement/turbine-overview/v100-1.8-mw.aspx#/vestas-univers>.

5 Turbine information is available at GE's website <http://www.ge-energy.com/products_and_services/products/wind_turbines/ge_1.6_100_wind_turbine.jsp>.

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 4 below.

Table 4: Project Emissions Reductions Estimation

Years*	**Annual estimation of emission reductions in tonnes of CO_2e**
2014	110,576
2015	263,793
2016	263,793
2017	263,793
2018	263,793
2019	263,793
2020	263,793
2021	153,217
Total estimated reductions (tonnes of CO_2e)	**1,846,551**
Total number of crediting years	7.00
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	263,793

**Starting on August, 01st 2014*
*** Until July, 31st 2021*

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 3.0.1).

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 comprises seven greenfield 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 seven new wind power plants.

– *In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existent 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 results in the creation of a new single reservoir or in the increase in an existing single reservoirs where the power density of the reservoir is less than 4 W/m^2.*

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. Further, 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.

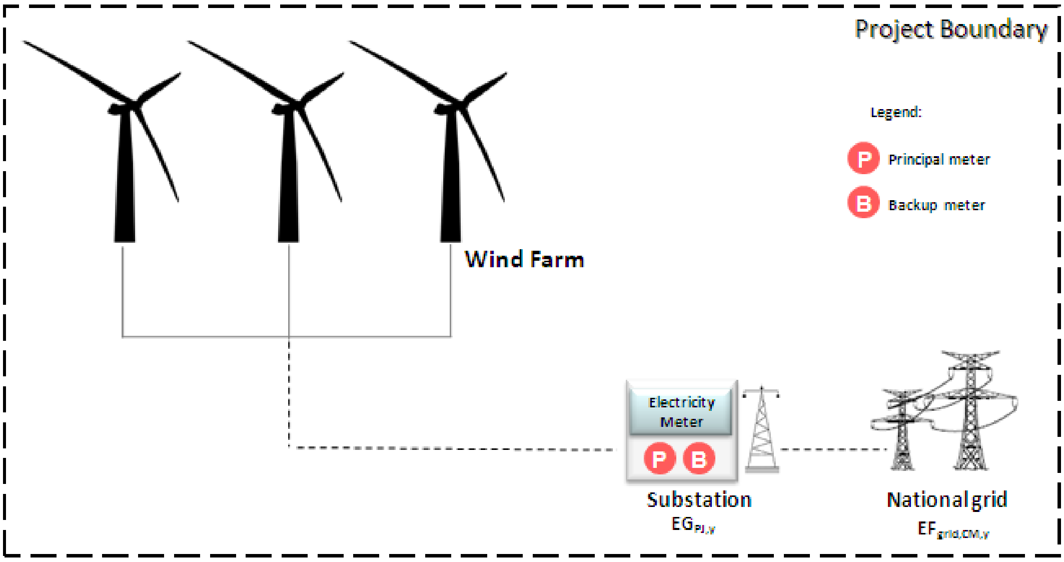

Figure 2: Project boundary

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

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

	Source	*Gas*	*Included?*	*Justification/Explanation*
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from	Not applicable.		

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

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

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

The project activity is the installation of seven new grid-connected renewable power plants/units. 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 22/12/2012, which represents the forecasted date when the PPA is expected 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 13, EB62), no communication has to be made regarding CDM consideration, since the beginning of the GSP itself demonstrate that CDM is being considered.

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 *Zeta Energia S.A.* as well as Omega Energia Renovável S.A. focus in the development of electricity generation projects using alternative sources. As described above in section A.2., these last two companies prospect renewable energy projects, focusing on wind energy and hydropower electricity generation, respectively. 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 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.

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*), Rio Grande do Norte Environmental Agency (IDEMA from the Portuguese *Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte)* and the CDM Executive Board.

SATISFIED/PASS – Proceed to Step 2

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method:

The 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 project Internal Rate of Return (IRR) calculated in the project activity cash-flow. The IRR here presented for the project activity is going to be compared to the appropriate benchmark of the electric sector (in accordance with paragraph 12, Annex 5, EB 62), 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 December 2012, when the PPA is expected to be signed. Therefore, the most recent information available at the time the GSP started is going to be used to estimate the WACC of the sector, *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).

Benchmark - 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 sectorial benchmark is applicable as per the guidance provided in paragraph 13, Annex 5, EB62. The WACC is calculated through the formula below:

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

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.

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

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

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 ($\boldsymbol{\pi}$). 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% (actual profit) or 0% (presumed profit). 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 flow is post-tax. Thus, it 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.

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)[9]. Please, see Table 6 as an example.

[8] Publicly available in Portuguese at http://www.receita.fazenda.gov.br/legislacao/leis/Ant2001/lei971898.htm.
[9] Publicly available in Portuguese at http://www.receita.fazenda.gov.br/legislacao/rir/L2Parte3.htm.

Table 6: Income Tax and Social Contribution (illustrative calculation)

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

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

Source: KPMG. "Investment in Brazil: tax." (2008) [23].

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 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 7.

Table 7: Cost of debt (Kd) calculation

Cost of Debt (Kd) = [1 + (a + b + c) x (1 - t)] / [(1 + π) -1]	
(a) Financial cost[10]	6.53%
(b) BNDES remunaration[11]	0.90%
(c) Credit risk rate[12]	2.00%
(a+b+c) Pre-Cost of Debt	9.43%
(t) Marginal tax rate[13]	0%
(d) Inflation forecast[14]	4.50%
After tax Cost of Debt	4.71%p.a.

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

Cost of Equity (Ke)

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

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

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

In order to adjust the risk-free rate (**Rf**) to the inflation adjusted rate, the expected inflation rate (for the United States) (**π'**) is reduced. For its calculation is considered the 10 Year Treasury Note (^TNX), and the TIPS (Treasury Inflation Protected Securities), which are readily quoted in the US market. The ^TNX index carries inflation on their value while the TIPS is an index without inflation. The subtraction from the chosen period average values from the ^TNX and the TIPS results in the estimated inflation. There is no need to adjust for Brazil's expected inflation when dealing with a hurdle rate in real terms.

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

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

Note that in the formula above there is the factor EMBI+ (Emerging Markets Bond Index Plus), from J.P. Morgan, 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 *8*.

Table 8: 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[15]	4.25%
(Rm) Equity risk premium[16]	6.03%
(Rc) Estimated country risk premium[17]	2.45%
(β) Sectorial Risk[18]	1.55%
(I) US expected inflation[19]	1.98%
Cost of Equity with Brazilian Country Risk (p.a.)	14.05%p.a.

Finally, plugging these numbers into WACC formulae:

WACC = 50.00% x 4.71% + 50.00% x 14.05% = 9.38%

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). According to the Guidance 3 of the "*Guidelines on the Assessment of Investment Analysis*" (EB 62, Annex 5), the period of assessment should not be limited to the proposed crediting period of the CDM project activity. The calculation shall as a preference reflect the period of the wind power plants expected operational life. Therefore the project activity cash flow, which considers the seven sites over their lifetime of 20 years, shows that the IRR of the project is 3.39%.

In addition, 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 input values are based on the most recent information available at the time the GSP of the project started.

Sources of all input values used to estimate the IRR of the project are detailed in the IRR calculation spreadsheet, which is also attached to this PDD.

[15] http://pages.stern.nyu.edu/~adamodar/
[16] http://pages.stern.nyu.edu/~adamodar/
[17] http://www.cbonds.info/all/eng/index/index_detail/group_id/1/
[18] http://pages.stern.nyu.edu/~adamodar/
[19] http://www.federalreserve.gov/econresdata/researchdata.htm

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"[20]). 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.

The Guidance 6 from the "Guidelines on the Assessment of Investment Analysis" (EB 62, Annex 5) states that: "Input values used in all investment analysis should be valid and applicable at the time of the investment decision taken by the project participant". For the Presumed Profit eligibility, corporate entities revenues must be under R$ 48 million per year (Article #13, Law #9.718/1998)[21]. Since the project activity revenue is under R$ 48 million per year, they were able to choose for the Presumed Profit system.

The relevant assumptions made are in accordance with the *Guidelines on the Assessment of Investment Analysis* (version 05). 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.

[20] 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

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

Table 9: Description and justification of the parameters used in the investment analysis.

Parameter	Touros 1	Touros 2	Touros 3	Touros 4	Touros 5	Touros 6	Touros 7	Justification/source of information used
Installed Capacity (MW)	28.80	28.80	16.20	28.80	17.60	28.80	28.80	Based on the project design of the wind farms. The win studies were conducted by Camargo Schubert and supplied to the DOE.
Plant Load Factor (%)	44.23	41.46	44.18	46.41	44.12	43.22	44.44	Value estimated by the wind certification compan probability (P50). This range of probability represe chance of higher or lower generation of electricity by t is range is conservative. As an example, the financi usually consider P90 for the financing agreement. An a 43.99% was used in the investment analysis.
Price (BRL/MWh)	97.00 to 127.00							The price considered in the investment analysis is the the Settlement Price for the Differences (from the Por *de Liquidação das Diferenças – PLD*) of the Northe Brazil in a study conducted by a third party. The price the years as verified in the project activity cash flow.
TUST (BRL/kW/month)	2.52 to 4.27							In Brazil, electricity producers using renewable sou 50% discount in the Tariff for the Use of the Transmis TUST fee (from the Portuguese *Tarifa de Uso d Transmissão*). This discount aims at boosting in renewable energy projects and shall be considered policy as defined by Annex 3, EB 22. Additionally, ac clarification, type E- policies[22] do not need to be con

[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).*

		development of the baseline scenario if implemen November 2001. The reduction in the TUST fee was re Law 10,438, dated 26/04/2002[23]. Therefore, the discou to be taken into account. The value used is in accord ANEEL Ordinance# 1.180, dated July 18th, 2011.
Corporate Income Tax and social contribution (1,000BRL/year)	972	For the Presumed Profit system, 8% of the gross sales financial revenues/earnings is used as basis for the calculation. To this figure a 25% rate is applied resulti income tax value. For the social contribution calcul gross sales in addition to financial revenues/earnings basis for the calculation. To this figure a 9% rate is app in the final social contribution value (As per Article Federal Decree #3000, dated 26 March 1999).
IPI	It is already included in the total investment	IPI stands for a tax over industrialized products. Si federal government agreed to exempt wind turbines fro tax. Considering that this policy is specific for win rather, the policy creates incentives for less GHG emis technology (Type E- policy), the exemption was not this sense, the total cost of wind turbines was increas the positive effect of the policy was not reflected in th determined for the project.
Investment (1,000 BRL)	715,703	Based on quotations from the manufacturers as well as services providers. Electronic copies of the document the DOE.
Project – IRR (%)	**3.39**	**Calculated in the attached spreadsheet.**

[23] Available in Portuguese at <http://www.aneel.gov.br/cedoc/lei200210438.pdf>. Accessed on 28/04/2011.

The project IRR as presented to the DOE is 3.39%, i.e., lower than the WACC of the sector. Therefore, this number shows that the project activity is not financially attractive to the investor. The results are summarized in the table below.

Table 10: Comparison between Project IRR and the Weighted Average Cost of Capital

Wind Power Plant	IRR (%)	WACC (%)
Lagoa de Touros CDM Wind Power Plants Project Activity	3.39	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 of the sensitivy analysis considering a variation of the selected parameters by 10%, are presented in Table 11.

Table 11: Sensitivity analysis (10% variation)

Scenario	IRR %
Increase in the tariff	4.72
Increase in electricity generation	4.72
Reduction in project investments	4.50

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 the wind power plants are presented in the tables below.

Table 12: Scenarios when IRR of the project activity equals the benchmark (9.38%).

	IRR %	*PRICE (BRL/MWh)*	*INVESTMENT (1,000BRL/MWh)*	*ELECTRICITY (MWh/yr)*	*Variation (%)*
Original	3.39	97.00 to 127.00	715,703	669,366	N/A
Price	9.38	146.18 to 191.39	715,703	669,366	50.70
Investment	9.38	97.00 to 127.00	424,412	669,366	40.70
Electricity	9.38	97.00 to 127.00	715,703	1,008,735	50.70

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 investment analysis is based on the the *PLD)* of the Northeast region of Brazil. The study was conducted by PSR, an independent consultant company specialized in studies of the electrical sector in Brazil. The *PLD* identify the purchase and the sale of electric power in the short term market and is defined as the "*spot price*" disclosed by the Chamber of Electrical Energy Commercialization (CCEE – *Câmara de Comercialização de Energia Elétrica*). The *PLD* is determined considering the Electric System National Operator (from the Portugues *Operador Nacional do Sistema – ONS*) data for the optimization of the Brazilian Interconnected System operation. Furthermore, the last auctions show that the energy price has decreased, as observed in the 2nd, 3rd and 4th Reserve Energy Auctions occurred in 2009, 2010 and 2011, respectively. The average price obtained by project developers in the mentioned auctions are respectively, R$148.39/MWh, R$122.69/MWh and R$99.57/MWh Hence, an increase in the project IRR due to an increase in the price of electricity is very unlikely.

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 the proposed CDM 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 (except the proposed project activity):

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:

Not applicable since the proposed project activity is listed as one of the measures described in paragraph 6 of the tool, as further discussed below.

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

Not applicable since the proposed project activity is listed as one of the measures described in paragraph 6 of the tool, as further discussed below.

In accordance with paragraph 47 of the additionality tool, a stepwise approach is 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.

Lagoa de Touros Wind Power Plants CDM Project Activity matches option (b) since it consists of a switch from grid electricity to electricity generation from wind power plants[24].

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

The seven wind power plants considered in this CDM Project Activity sum 177.8 MW of installed capacity. Taking into account the above range, the common practice analysis will be conducted considering projects possessing an installed capacity between 88.9 MW and 266.7 MW.

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;*

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

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:

> *"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[25], 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.

[25] 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>.

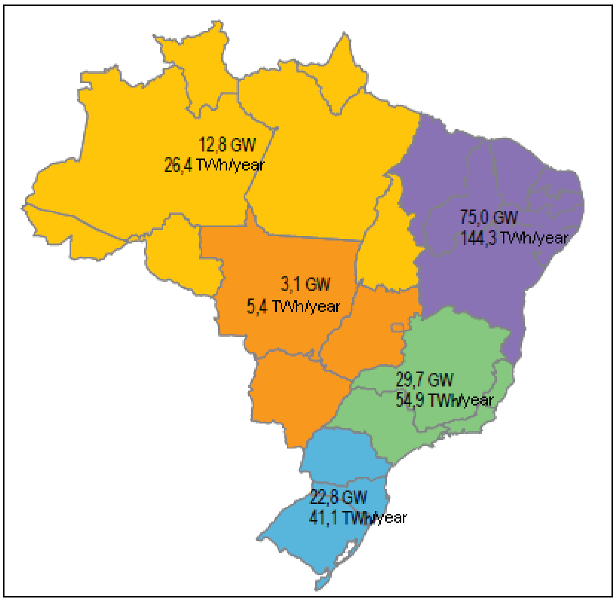

Figure 4: Brazilian wind resource potential[26].

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 Alagoas state (located in the same region of Rio Grande do Norte) was BRL 7.35/kW and BRL 3.51/kW in Rio Grande do Norte state (more than two times lower than Alagoas).

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.

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

In summary, taking into account the definitions presented above, only grid-connected wind power plants; with an installed capacity between the range established in *Step 1* above and located in Rio Grande do Norte state were considered. Other CDM Project Activities, defined by the tool as the ones *registered (...)* and that

[26] 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>.

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 (October 26th, 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 (88.9MW – 266.7MW), 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 Rio Grande do Norte 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,

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

Wind power projects represent 0.94% of the operational plants in the country (Figure 5). Despite of the modest share of wind electricity in the Brazilian energy matrix, the proposed CDM Project Activity cannot be considered common practice and therefore is not a business as usual type scenario. From the analysis presented above it is clear that in the absence of the incentive created by the CDM this project would not be the most attractive scenario.

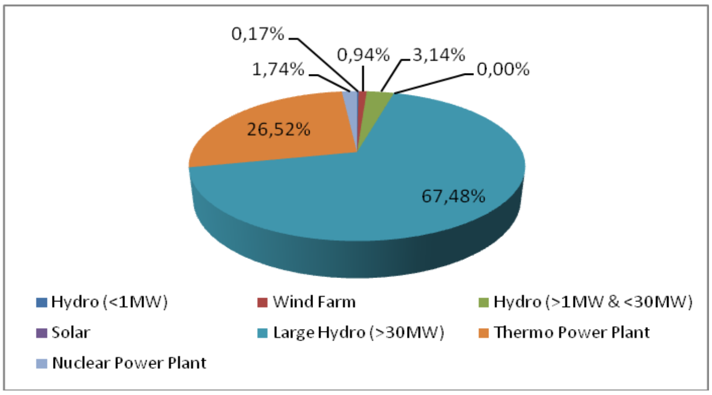

Figure 5 – Brazilian electricity matrix as of April 2011 (Source*:* ANEEL, (2011)[27])

Therefore, *Lagoa de Touros Wind Power Plants CDM Project Activity* is not a common practice.

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.

$$ER_y = BE_y - PE_y \qquad \textbf{Equation 1}$$

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:

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

Where,

BE_y = Baseline emissions in year y (tCO_2);

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

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

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

$$EG_{PJ,y} = EG_{facility,y} \qquad \textbf{Equation 3}$$

Where,

[27] 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);

$EG_{facility,y}$ = 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 26^{th} 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/327118.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

In terms of data vintage, the project participants have chosen Option 2 for the calculation of the build margin emission factor. As set out in the tool, this option requires the build margin emission factor to be updated annually.

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 reservoirs of hydro power plants in year *y* (tCO_2e).

<u>*Emissions from fossil fuel combustion ($PE_{FF,y}$)*</u>

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

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

Considering that the proposed project activity consists 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, $PE_{GP,y}$ = 0 tCO_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, $PE_{HP,y}$ = 0 tCO_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 0 tCO_2.

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

Data / Parameter:	w_{OM}
Data unit:	%
Description:	Weighting of the operating margin emissions factor
Source of data used:	*"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.75
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default weight value for Operating Margin for wind power generation project activities according to the "*Tool to calculate the emission factor for an electricity system*". As described above in section B.6.1., method a) provided by the tool is used.
Any comment:	-

Data / Parameter:	w_{BM}
Data unit:	%
Description:	Weighting of build margin emission factor
Source of data used:	*"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.25
Justification of the	Default weight value for Build Margin for wind power generation project

choice of data or description of measurement methods and procedures actually applied :	activities according to the "*Tool to calculate the emission factor for an electricity system*". As described above in section B.6.1., method a) provided by the tool is used.
Any comment:	-

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 determined, for the purpose of ex-ante estimative as being equal to the installed capacity of each plant multiplied by the capacity factor - as determined by the Wind Certifications conducted by Camargo Schubert (in line with option *b)*, paragraph 3, Annex 11, EB 48) – and by the number of hours in which the plant is operational during year *y*.

Additionally, the amount of electricity established in the Electric Power Commercialization Agreements within the Regulated Ambience (from the Portuguese *Contratos de Comercialização de Energia Elétrica no Ambiente Regulado* - CCEAR) must be the estimated amount of electricity to be dispatched to the grid in the Gravity Point[28] of the system. Therefore, the transmission losses have to be discounted from the estimated total electricity to be generated by the plant. These losses were estimated as being equal to 2.3%.

In total, the seven wind Power Plants considered in this CDM Project Activity will generate 669,366MWh to be dispatched into the grid. The result for each of the plants is presented below in Table 13.

Table 13: Net electricity generation by the wind plants of the CDM Project Activity

Wind Power Plant	Installed Capacity (MW)	Capacity Factor (%)	Net electricity generation (MWh)
Lagoas de Touros 1	28.80	44.23	111,581
Lagoas de Touros 2	28.80	41.46	104,591
Lagoas de Touros 3	16.20	44.18	62,690
Lagoas de Touros 4	28.80	46.41	117,092
Lagoas de Touros 5	17.60	44.12	68,018
Lagoas de Touros 6	28.80	43.22	109,046

[28] According to the Electric Power Commercialization Chamber (from the Portuguese *Câmara de Comercialização de Energia Elétrica* – CCEE), *the SIN is represented at the CCEE through a structure made-up of the commensuration of consumption and generation points. (…)There is need for adjustments because losses of electricity occur in the transmission system while the consumption through generation is being accomplished. At CCEE these losses are apportioned among the Agents which own the consumption and generation commensuration points. Through the apportionment of these losses an assurance is given that the total effective generation of the system will be consonant with the total effective load of the system. The virtual point where the losses of the generation and consumption points become even is called the* ***Gravity Point****, and at this point all the purchases and sales of electric power at the CCEE are computed.*

Lagoas de Touros 7	28.80	44.44	112,106
Total	**177.8**	**-**	**685,124**
		Transmission losses (-2.3%)	**669,366**

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 system

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

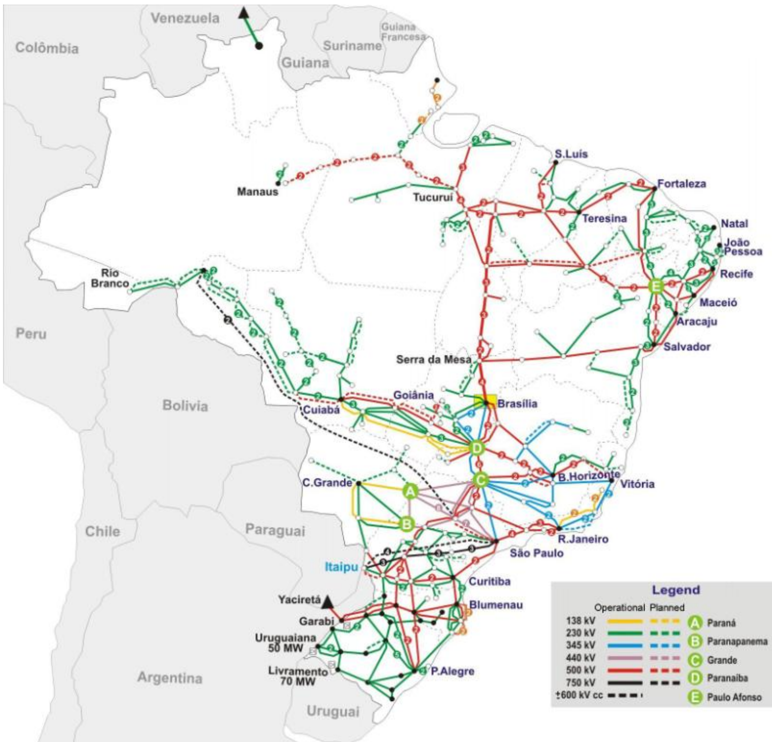

Figure 6: Brazilian Interconnected System. (*Source:* Electric System National Operator)

- **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.

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

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

The Brazilian DNA made publicly available the build margin emission factor. For the purpose of estimative, 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.

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

- **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,

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

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

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

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

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

$EG_{PJ,y} = EG_{facility,y}$ = 669,366MWh

BE_y = 669,366MWh x 0.3941tCO_2/MWh

BE_y = 263,793tCO_2

Project Emissions (PE_y)

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

PE_y = 0 tCO_2e

Leakage emissions (LE_y)

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

LE_y = 0 tCO_2.

Emission reductions (ER_y)

Applying the results discussed above to Equation 1 we obtain,

$ER_y = BE_y - PE_y$

ER_y = 263,793tCO_2

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

Table 14: 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)
2014*	0	110,576	0	110,576
2015	0	263,793	0	263,793
2016	0	263,793	0	263,793
2017	0	263,793	0	263,793
2018	0	263,793	0	263,793
2019	0	263,793	0	263,793
2020	0	263,793	0	263,793
2021**	0	153,217	0	153,217
Total (tonnes of CO_2e)	**0**	**1,846,551**	**0**	**1,846,551**

**Starting on August 1st, 2014*
*** Until July 31st, 2021*

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:	Project Activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Lagoas de Touros I – 109,015
Description of measurement methods	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

and procedures to be applied:	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). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured. The information will be cross checked using 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.
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:	Project Activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Lagoas de Touros II – 102,185
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). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured. The information will be cross checked using 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.
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:	Project Activity site
Value of data applied for the purpose of calculating expected emission reductions in	Lagoas de Touros III – 61,248

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). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured. The information will be cross checked using 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.
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:	Project Activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Lagoas de Touros IV – 114,399
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). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured. The information will be cross checked using 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.
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:	Project Activity site
Value of data applied	Lagoas de Touros V – 66,454

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). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured. The information will be cross checked using 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.
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:	Project Activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Lagoas de Touros VI – 106,538
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). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured. The information will be cross checked using 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.
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:	Project Activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Lagoas de Touros VII– 109,528
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). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured. The information will be cross checked using 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.
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/327118.html#ancora)
Value of data applied	Large amount of data.

for the purpose of calculating expected emission reductions in section B.5	
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/327118.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:	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*" (Option 2 of the tool).
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	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

applied:	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[29] 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[30]. 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[31].

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[32]. In addition, ONS also rules about the electricity meter calibration requirements (every two years)[33].

There will be two energy meters (principal and backup) located at the substation, as specified by CCEE[34]. Before the operation starts, CCEE demands that these meters are calibrated by an entity with Brazilian Calibration Network (RBC from the Portuguese *Rede Brasileira de Calibração*) 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.

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[29] Information available at <http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en>.
[30] Information available at <http://www.aneel.gov.br/>.
[31] Information available at : <http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=25afa5c1de88a010VgnVCM100000aa01a8c0RCRD>.
[32] 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.
[33] 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.
[34] 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>.

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) 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 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. 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): 25/07/2011.

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) 22/12/2012

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*".

In order to determine project activity's starting date the forecasted date for the following events can be considered: **construction permit issuance, financing agreement, Power Purchase Agreement, major equipment orders and start of construction**. However, none of these events have yet taken place.

Nevertheless, the wind power plants considered in this CDM Project Activity are qualified to participate in the government energy auction that will take place in 2012[35]. In this sense, the main events related to the plants' implementation are connected to the assumption that plants may win the auction, which are forecasted to happen as follows:

Table 15: main events related to Touros 1, 2, 3, 4, 5, 6 and 7 wind power plants.

Events†	***Lagoas de Touros 1,2, 3, 4, 5, 6 and 7***	***Justification***
Construction Permit Issuance	01/06/2013	One month before the construction starts
Major Equipment Orders	01/01/2013	Six months before the construction starts
Starting Date of Construction	01/07/2013	18 months before the operation starts
Power Purchase Agreement (PPA)	22/12/2012	9 months after the auction[36].
Financing Agreement	22/06/2013	6 months after the PPA is signed

† Estimated: based on A-3 2012 New Energy Auction which requires the plant to be operational by January 1st, 2015.

[35] Ministry of Mines and Energy Ordinance #554, dated September 23rd, 2011. The document is available at http://www.ccee.org.br/StaticFile/Arquivo/biblioteca_virtual/Leiloes/3%20Energia%20Nova/prt2011554mme.pdf. The auction was postponed as detailed in the Mines and Energy Ordinance #102, dated March 6th, 2012 available at http://www.ccee.org.br/StaticFile/Arquivo/biblioteca_virtual/Leiloes/2_Energia_Nova/prt2012102mme.pdf.

[36] This stretch of time was based on the time elapsed between the auction and PPA signature observed in the previous A-3 auction (http://www.aneel.gov.br/aplicacoes/editais_geracao/documentos/Cronograma_02-12-11.pdf)

As observed above, the first event related to the implementation of the proposed project activity is expected to occur in December 2012. This is the date when the PPA is expected to be signed. Commonly, several necessary steps to build the wind power plants, such as the financing contract, are only obtained after the signature of the Power Purchase Agreement. Nevertheless, if the company decides not to build the plant after the signature of the PPA there would be relevant penalties.

Hence, although this event neither can be considered as the financial closure nor represents a significant expenditure related to the implementation of the plant, the project developer will be committed to the terms of the contract assuming that the wind power plant is in fact going to be implemented. Therefore, this must be considered the project starting date.

From the above, the identified starting date of the proposed project activity is 22/12/2012.

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) 01/08/2014 or at the date of registration whichever occurs later.

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[37], wind power plants must do a simplified environmental impact assessment in order to obtain the necessary licenses to the project.

Permits required by CONAMA.(Resolution # 237/97[38]) are:

- The Preliminary Permit (*Licença Prévia* or LP);
- The Construction Permit (*Licença de Instalação* or LI); and
- The Operating Permit (*Licença de Operação* or LO).

The process starts with a previous analysis by the local environmental department of the simplified environmental impact assessment. The result of those assessments is the Preliminary Permit (LP), which reflects the local environmental agency positive understanding regarding the environmental project concepts.

In order to obtain the Construction Permit (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 Permit (LO) is a result of pre-operational tests during the construction phase to verify if all demands made by environmental local agency were completed.

All plants possess the Preliminary Permits (from the Portuguese *Licença Prévia – LP*) which were issued by Rio Grande do Norte Environmental Agency (*IDEMA – Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte*). The LP number of each power plant as well as the issuance date and the expire date are described below:

Table 16: Wind Power Plants Preliminary Licenses data.

Wind Power Plant	LP Number	Issuance Date	Expiry Date
Touros 1	2010-037817/TEC/LP-0122	05/07/2010	05/07/2012

[37] Available at: http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=277
[38] Available at: http://www.mma.gov.br/port/conama/legiabre.cfm?codlegi=237

Touros 2	2010-037815/TEC/LP-0120	05/07/2010	05/07/2012
Touros 3	2011-043866/TEC/LP-0065	20/06/2011	20/06/2013
Touros 4	2011-043868/TEC/LP-0067	17/06/2011	17/06/2013
Touros 5	2011-043867/TEC/LP-0066	17/06/2011	17/06/2013
Touros 6	2011-043869/TEC/LP-0068	17/06/2011	17/06/2013
Touros 7	2011-044376/TEC/LP-0074	17/06/2011	17/06/2013

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 and comply with the possible exigencies made by the Environmental Agency in order to obtain the necessary permits to the project. Given the project already possesses the preliminary environmental permit, it can be concluded that it does not indicate in significant negative transboundary environmental impacts; otherwise the permit 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[39], 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;

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

– 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 29/09/2011 which is also the date when the invitation letters were sent to the following agents:

– *Prefeitura de Touros* (Touros City Hall)

– *Câmara Municipal de Touros* (Municipal Assembly of Touros)

– *Secretaria do Meio Ambiente de Touros* (Environmental Agency of Touros)

– *Sindicato dos Trabalhadores Rurais de Touros* (Comunitarian Association of Touros)

– *Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte - IDEMA* (Rio Grande do Norte Environmental Agency)

– *Ministério Público Federal* (State Attorneys for the Public Interest of Brazil)

– *Ministério Público do Rio Grande do Norte* (State Attorneys for the Public Interest of Rio Grande do Norte 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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