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: *Renova 2010 Wind Parks.*

Version number of the document: 03

Date (DD/MM/YYYY): 23/03/2012

A.2. Description of the project activity:

The primary objective of *Renova 2010 Wind Parks* 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 in the electricity generation sector, 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, possible eligibility under the Clean Development Mechanism of the Kyoto Protocol 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 comprises of six wind power plants: *Da Prata Wind Power Plant*, *Dos Araçás Wind Power Plant*, *Morrão Wind Power Plant*, *Seraíma Wind Power Plant*, *Tanque Wind Power Plant*, and *Ventos do Nordeste Wind Power Plant*. These plants present a total installed capacity of 162 MW and are better described below in section A.4.3. The plants are expected to become operational in September 2013 and are located in the municipalities of Igaporã, Pindaí, Guanambi and Caetité, Bahia State, in the Northeast region of Brazil.

The Wind Parks are a cleaner source of electricity that will also provide an important contribution to environmental sustainability by reducing carbon dioxide emissions that would have occurred otherwise in the absence of the project. No electricity has ever been generated in the sites where the wind parks 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.

Special Purpose Companies (SPCs) will be set up specifically to build and operate the proposed wind power plants. The major shareholder of these SPCs is *Renova Energia S/A.*, a company which operates in the electricity generation market embracing alternative renewable sources, such as small hydroelectric power plants (SHPs) and wind energy. Renova group was founded in 2001 and is nowadays recognized as a solid reference in the clean energy sector. It already has three SHPs in operation – the Serra da Prata Hydroelectric Complex, in the state of Bahia, totaling 41.8 MW – and 20 wind farms in the states of Bahia totaling 456 MW under implementation. In addition, the company has a great portfolio of alternative renewable sources distributed in the states of Bahia, Minas Gerais, Mato Grosso, Maranhão, Goiás, Tocantins and Paraná.

Renova partners include Fundo InfraBrasil and FIP Caixa Ambiental, both funds independently managed by Santander Bank, in conjunction with two young entrepreneurs, experts in the alternative energy sector and the company's founders (Ricardo Delneri and Renato Amaral). Fundo Infrabrasil and FIP Caixa Ambiental, which have important quota holders from Brazilian pension funds and financial institutions, are signatories of the Equator Principles, which demands a variety of verifications and obligations for the concession of financing for projects of environmental impact. This reinforces Renova's commitment to the best practices of corporate governance, sustainability and environmental preservation.

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 sustainable development according to the following aspects:

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

- 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 will reduce environmental impacts and help 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:

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

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

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil

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

Bahia

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

Igaporã, Pindaí, Guanambi and Caetité 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 the site is presented in the table below.

Wind Power Plant	*Geographic Coordinates*[4]	
Da Prata	*Longitude (West)*	42°38’23’’
	Latitude (South)	13°57’54’’
Dos Araçás	*Longitude (West)*	42°34’51’’
	Latitude (South)	14°27’21’’
Morrão	*Longitude (West)*	42°42’21’’
	Latitude (South)	14°8’4’’
Seraíma	*Longitude (West)*	42°36’48’’
	Latitude (South)	14°05’9’’
Tanque	*Longitude (West)*	42°36’49’’
	Latitude (South)	14º7’5’’
Ventos do Nordeste	*Longitude (West)*	42°35’20’’
	Latitude (South)	14°30’57’’

[4] The geographic coordinates of the wind parks were taken from the optimized wind certification conducted by GL Garrad Hassan. The information corresponds to the location of the first wind turbine of each park. The documents were supplied by the DOE.

Figure 1 –Bahia state (top right corner) and the municipalities where the wind parks are located (represented by numbers 2, 4, 6 and 15)[5]

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 proposed project activity comprises six of wind power plants at 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 above in section A.2., 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.

Utilizing wind energy requires the installing of a device which converts kinetic energy in the atmosphere into usable energy[6].A wind turbine is a device for extracting kinetic energy from the wind[7]. Wind turbines generate electricity and feed it directly to the grid. They commonly have two or three rotor blades, a horizontal axis, a nacelle with a rotor hub, gears, and a generator, all of which can be turned into and out of the wind. The

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[5] Source: http://www.citybrazil.com.br/ba/caetite/l1.php?micro=26. Accessed on 18 April 2011.

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

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

rotor is positioned in front of the tower in the direction the wind is blowing (windward as opposed to leeward)[8]. The figure below presents the basic components of a modern wind turbine.

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

Figure 2 – Schematic view of the components of a wind turbine. (Source: WWEA, 2006[8]).

The project activity consists of the construction of six wind power plants resulting in 162 MW of total installed capacity. The turbines to be used by the plants are GE 1.6XLE Wind Turbines Series all manufactured by General Electric. The technical characteristics of this model of turbine are described in Table 2 below.

There is a different number of units to be installed in each of the plants considered in this CDM Project Activity. At Da Prata and Ventos do Nordeste Wind Power Plants, there will be 14 units in each site, resulting in a total 22.4MW of installed capacity each; at Dos Araçás, Morrão and Seraíma Wind Power Plants, there will be 19 units in each site, resulting in a total 30MW of installed capacity each[9]; and at Tanque Wind Power Plant 17 units will be installed at the site, resulting in a total 27.2MW of installed capacity.

Table 2 – Project's equipment technical description[10].

Turbines	
Model	1.6 XLEWind Turbines Series
Nominal Power (MW)	1.6
Manufacturer	GE do Brasil Ltda.
Cut-in wind speed (m/s)	3.5
Cut-out wind speed (m/s)	25

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

[9] The installed capacity of Dos Araçás, Morrão and Seraíma wind Power Plants considering 19 turbines of 1.6MW each will be installed in each site is equal to 30.4MW. However, the installed capacity of these plants was limited to 30MW. The turbines that will have the capacity limited are highlighted in the wind certification.

[10] Turbine information is available with the Project Participants and at GE's website: <http://www.geenergyfinancialservices.com/press_room/publications/GEA14954C15-MW-Broch.pdf >

The technology and equipment described above are already established in the industry and have been successfully used. Thus, no adverse effects to human health as well as the environment are expected from their installation.

Some components of the wind turbines, such as the blades, are built locally. Therefore, although they contribute to only a part of the project implementation, it can be said that expansion of wind power plant electricity generation favors the local industry and contributes to the transfer of technology to the Host Country.

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

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

Table 3 – Project Emissions Reductions Estimation

Years*	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 1	166,924
Year 2	166,924
Year 3	166,924
Year 4	166,924
Year 5	166,924
Year 6	166,924
Year 7	166,924
Total estimated reductions (tonnes of CO_2e)	**1,168,468**
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	166,924

**From September 1st of a given year up to August 31st of the subsequent year*

A.4.5. Public funding of the project activity:

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

SECTION B. Application of a baseline and monitoring methodology

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

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

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

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 plants considered in this project activity are all 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 six 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 existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;*

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

– *In case of hydro power plants:*

- *At least one of the following conditions must apply:*
    - o *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^2after 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 4 W/m^2 after the implementation of the project activity all of the following conditions must apply:

- *The power density calculated for the entire project activity using equation 5 is greater than 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 project1 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 4 W/m^2, is lower than 15MW;*
- *The total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.*

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

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 reservoir 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[11] 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.

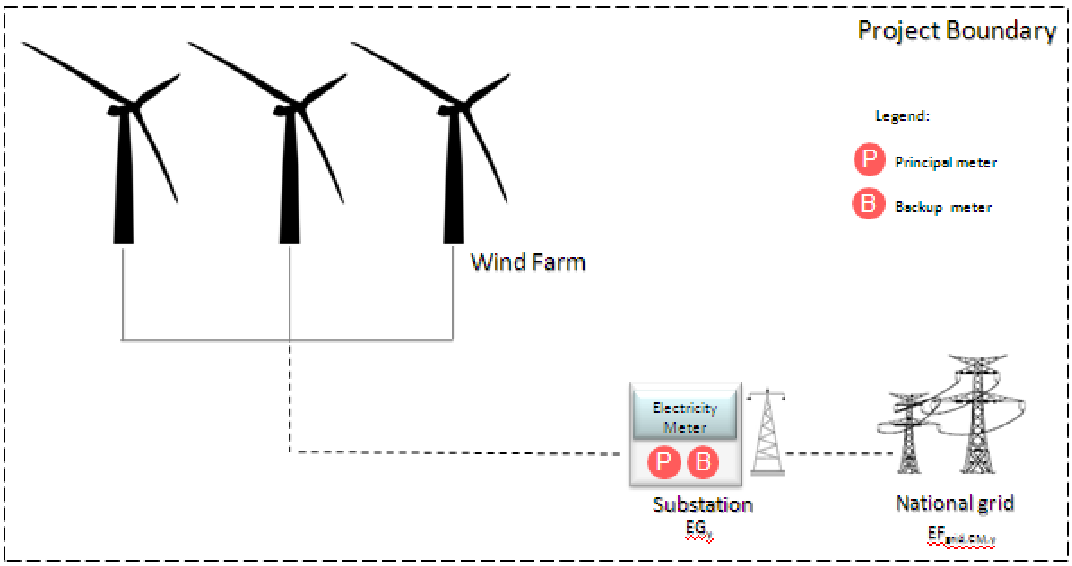

Figure 3 - Project boundary

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

Table 4 - Emissions sources included or excluded in the project boundary

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

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source.
		CH_4	No	Minor emission source.
		N_2O	No	Minor emission source.
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from noncondensable gases contained in geothermal steam.	Not applicable.		
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	Not applicable.		
	For hydro power plants, emissions of CH_4 from the reservoir.	Not applicable.		

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

The project activity is the installation of six new grid-connected renewable power plants. 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 26 August 2010, which represents the date when the MoU signed between the project developer and the equipment supplier took effect, representing the first relevant commitment towards the implementation of the project. For details on how the project starting date was identified please refer to Section C.1.1.

In accordance with the "*Guidelines in the demonstration and assessment of prior consideration of the CDM*" (Annex 13, EB 62), for projects activities with a starting date on or after 02 August 2008, Project Participants must notify the host country DNA the UNFCCC secretariat of their intention to seek CDM status.

Project Participants have forwarded the Prior Consideration of the CDM Form (F-CDM-Prior consideration) both for the Brazilian Designated National Authority and to UNFCCC secretariat[12]. The forms as well as the confirmation are available under request and were presented to the DOE validating the project.

The additionality of the proposed project activity will be assessed and demonstrated trough 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 below further detailed.

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 consultant and does not invest in the construction and operation of Wind Power Plants. Further *Renova Energia S.A.* focuses on the development of electricity generation projects using alternative sources. As described above in section A.2., the company's portfolio is principally composed of small hydro power plants and wind power plants. In addition to this, the only possible resource to be used for electricity generation at the site where the plants are going to be located is the wind. Therefore, based on the nature of these two companies, namely the project participants, and the energy sources available at the site where the plants are going to be implemented, the only realistic alternatives to the project activity identified are:

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

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

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*), Bahia Environmental Agency (INEMA from the Portuguese *Instituto de Meio Ambiente e Recursos Hídricos*) and the CDM Executive Board.

SATISFIED/PASS – Proceed to Step 2

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method:

[12] The Prior Consideration Form was submitted to UNFCCC on 26 January 2011 (five months after the starting date of the project). Please refer to http://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html.

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 is the most appropriate method to demonstrate the additionality of the proposed CDM Project Activity once the alternative to the implementation of the wind power plant 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 Equity Internal Rate of Return (Equity IRR) calculated in the project cash-flow. The Equity IRR here presented is compared to the appropriate benchmark of the electric sector, which is the Cost of Equity (*Ke*) (in accordance with paragraph 12, Annex 5, EB62). Both indicators were calculated in real terms.

Once 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, after the project proponent obtains such authorization, the project may be sold to another developer. Therefore, the use of a sectoral benchmark is applicable as per the guidance provided in paragraph 13, Annex 5, EB62.

Finally, the Cost of Equity was calculated for 2010 – *i.e.* when the equipment supply agreement took effect representing the first significant commitment towards the implementation of the project.

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

Cost of Equity (Ke)

The Capital Asset Pricing Model (CAPM) is one of the most widely accepted models used to determine the required rate of return on equity. As per option b) provided in the paragraph 15 of Annex5, EB62, it was estimated using the best financial practices. The CAPM calculates a newly introduced asset's non-diversifiable risk. CAPM takes into account the asset's sensitivity to non-diversifiable risk, better referred to as Beta (β). Embedded in the model is also the market premium which can be tracked using historical data from the local or relevant equity market.

Renova 2010 Wind Parks is a post-tax cash flow. Thus, it must be compared against a sectoral post-tax benchmark. 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 cost of equity calculation the marginal tax, which is taken into consideration while re-leveraging the industry beta, is zero. Hence, the tax rate does not influence the re-leverage of beta, as follows:

*Re-levered beta = Unlevered beta * (1 + (1-(tax Rate) * (Wd/We))*

From the above, once the marginal tax is 0 (zero) (applicable for the Presumed Profit scheme), Post-tax rate is equal to Pre-tax rate. Thus, the calculated post-tax Cost of Equity is compared against the post-tax cash flow as recommended in paragraph 11 of Annex5, EB62.

The rate which should be charged for the equity component of a project is calculated through the formula: Ke = [(1+Rf)/(1+π)-1] + β*Rm + Rc where Ke represent the suggested rate of return for equity investments. Rf stands for the risk free rate and beta, or β, stands for the average sensitivity of comparable companies in that industry to movements in the underlying market.

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 the US treasury.

The risk-free rate used for Ke calculation was based on US Treasury bonds, which are long term titles of a mature market. Over this rate, Brazilian country risk (Rc) has been considered and resulted in the risk-free rate applied to the calculation.

β is 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.

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.

Table 5 – Cost of equity (Ke) calculation

Cost of Equity (Ke) – CAPM	
(Rf) Risk-free rate[13]	3.25%
(π) US expected inflation[14]	1.39%
(Rm) Equity risk premium[15]	6.58%
(Rc) Estimated country risk premium[16]	2.85%
(β) Adjusted industry beta[17]	2.11%

Plugging these numbers presented in (Table 5).above into *Ke* formulae, we obtain:

Ke = 18.54%

Each assumption made and all data used to estimate the benchmark has been presented to the DOE. The spreadsheet used for calculation of the *Ke* is available with the Project Participants and has also been provided

[13] Risk-free rate value (30-year US Treasury Yield) from Yahoo Finance available at: <http://finance.yahoo.com/q/hp?s=%5ETNX>.
[14] US expected inflation was determined by subtracting from the 10-year US Treasury (from Yahoo Finance) the 10-year US TIPS, taken from the US Federal Reserve information available at: <http://www.federalreserve.gov/econresdata/researchdata.htm>.
[15] S&P500 vs 10-year T.Bond Yield from Damodaran website <http://pages.stern.nyu.edu/~adamodar/>
[16] EMBI+Brazil from JP Morgan available at http://www.cbonds.info/all/eng/index/index_detail/group_id/1/
[17] Market weighted average Beta US power Co. re-levered to Brazilian leverage from Damodaran website <http://pages.stern.nyu.edu/~adamodar/>

to the DOE. For complete reference of the data used to estimate the benchmark please refer to this spreadsheet, which is also attached as an appendix to this PDD.

Financial Indicator, Internal rate of return (Equity IRR)

As mentioned above, the financial indicator identified for the Project Activity is the project Equity Internal Rate of Return (Equity - IRR). In line with the guidance of paragraph 3, Annex 5, EB62, *Renova 2010 Wind Parks*' cash flow was calculated considering an expected lifetime of 20 years (term of the PPA as well as expected lifetime of the plants).

Further, 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"[18]). There are also three methods provided by legislation to calculate corporate income tax and social contribution tax due on profits: Actual Profit, Presumed Profit and Arbitrated Profit.

Corporate entities are eligible to apply for the Presumed Profit if their revenues are under Forty eight million Reais per year (Article #13, Law #9.718/1998)[19].

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)[20].

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. Nevertheless, although depreciation does not influence the final result, it was considered in the spreadsheet (paragraphs 4 and 5 of Annex 5, EB62) since it is used to determine the fair value.

It should be noted that, in the present cash flow calculation the revenues from the electricity sail generated by all the plants is summed, representing the total revenue of the project. Nevertheless, Special Purpose Companies (SPCs) will be set for each of the wind power plants. In this sense, although the total revenues surpasses the 48 million limit for applying the Presumed Profit System, this system is still applicable since for each SPC the limit is not exceeded. This tax structure is supported by Article 16 of the Normative Instruction #480 issued by the Secretary of the Federal Revenues of Brazil, dated 15 December 2004[21], which allows companies to pay taxes proportionally to their shareholdings.

[18] 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
[19] Publicly available in Portuguese at http://www.receita.fazenda.gov.br/legislacao/leis/Ant2001/lei971898.htm.
[20] Publicly available in Portuguese at http://www.receita.fazenda.gov.br/legislacao/rir/L2Parte3.htm.
[21] Publicly available in Portuguese at http://www.receita.fazenda.gov.br/legislacao/ins/2004/in4802004.htm

The result is that the Equity IRR of the project is 10.76%. The financial indicator was calculated considering the implementation of all the wind farms simultaneously. This is justified since the assumptions made in the investment analysis would only be valid if all the wind farms were implemented.

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

Table 6 – Inputs for the IRR calculation.

Parameter	Value used	Justification/source of information used
Installed Capacity (MW)	158.4	This information corresponds to the total installed capacity of the plants as presented in the preliminary design of the wind farms. The preliminary wind certification studies were conducted by GL Garrad Hassam and were used as a basis for the investment decision.
Plant Load Factor – PLF (average for all wind farms)	53.74%	This value is the weighted average plant load factor from the preliminary project design of the plants, considering losses due to availability (informed by the manufacturer in the MoU), electrical efficiency and internal consumption of the plants (based on previous certifications obtained by the PPs for other plants), and transmission losses equivalent to 2.5%. As per the Power Purchase Agreement (PPA), the electricity will be negotiated at the Gravity Point of the Brazilian Interconnected System. The transmission losses can be confirmed using the Report Published by the Chamber for the Commercialization of Electric Power available at http://www.ccee.org.br/StaticFile/Arquivo/biblioteca_virtual/Relatorios_Publico/Anual/relatorio_anual_2009_2.pdf. The total revenue of the project is determined considering a fixed income from the energy negotiated during the auction and a variable income, corresponding to the surplus of electricity generated by the plants in a given year. The fixed revenues of the project over the assessment period are determined considering the share of energy commercialized in the auction (78MW) divided by the configuration of the wind parks under consideration (158.4MW). This yields a result of 49.24%. As per the PPA rules, project developers have to sell all electricity generated by the plants under the regulated market, regardless of the total electricity generated by the plant. The surplus is computed as the variable revenue following some specific regulations as follows: 1. Annually, revenues corresponding to the electricity generation exceeding 30% of the amount negotiated in the auction

		(101.4MW) are paid in the subsequent year considering 70% of the same tariff obtained in the auction; 2. Revenues associated with the electricity generated corresponding to the surplus of the negotiated energy (78MW) up to the 30% limit (101.4MW) is paid every four years considering the same tariff obtained during the auction. This variable revenue is monthly paid in 24 instalments. The calculation of the variable income is made considering points 1 and 2 above and addresses the difference between the plant load factor (53.74%) and the fraction of energy negotiated during the auction (49.24%), as explained previously.
PPA price (R$/MWh)	121.25	The price of the PPA, as submitted and obtained by the project owner in the energy auction conducted by the Chamber for the Commercialization of Electric Power in 2010.The results of the auction are publicly available at www.ccee.org.br. The investment decision (equipment supply agreement) coincides with the auction. In this sense, as per guidance 6 of Annex 5, EB62, the tariff considered in the investment analysis (obtained during the auction) is considered valid and applicable at the time of the investment decision.
TUST (R$/kW.month)	2.89	In Brazil, electricity producers using renewable sources receive a 50% discount in the Tariff for the Use of the Transmission System - TUST fee (from the Portuguese *Tarifa de Uso do Sistema de Transmissão*). This discount aims at boosting investments in renewable energy projects and shall be considered as a Type E- policy as defined by Annex 3, EB 22. Additionally, according to this clarification, type E-policies[22] do not need to be considered in the development of the baseline scenario if implemented after 11 November 2001. The reduction in the TUST fee was regulated by the Law10 438, dated 26/04/2002[23]. Therefore, the discount is not going to be taken into account. The value presented here corresponds to the average tariff set out by the ANEEL Resolution #1031, dated 22/07/2010 (available at http://www.aneel.gov.br/cedoc/reh20101031.pdf) over the assessment period. The tariff varies from 2013 up to 2019 and then remains fixed. For details please refer to the IRR calculation spreadsheet.
IPI	10% over the equipment	IPI stands for a tax on industrialized products. Since 2009 the federal

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

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

	cost	government has agreed to exempt wind turbines from paying this tax. Considering that this policy is specific for wind turbines, or rather, the policy creates incentives for less GHG emission intensive technology (Type E- policy), the exemption was not considered. In this sense, the total cost of wind turbines was increased by 10% so the positive effect of the policy was not reflected in the Equity IRR determined for the project.
Investment (BRL1,000)	Presented during the validation	Based on quotations from the manufacturers as well as from the EPC services providers. Electronic copies of the documents submitted to the DOE.

The Equity IRR, as presented to the DOE, is 10.76% (for complete reference, see IRR calculation spreadsheet supplied as an appendix to the PDD). This number shows that the Equity IRR of the project is lower than the Cost of Equity (*Ke*) of the sector – 18.54% – the benchmark. Hence, it is clearly demonstrated that the project activity is not financially attractive to the investor (Table 7).

Table 7 - Comparison between Project's EQUITY IRR and WACC of the sector

Project	Equity IRR (%)	Ke (%)
Renova 2010 Wind Parks	10.76	18.54

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

These 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 (Guidance 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 (Guidance 21 of Annex 5, EB62). The result is presented below in Table 8.

Table 8 – Sensitivity analysis

Scenario	% change	IRR (%)
Original	-	10.76
Increase electricity generation	10%	12.26
Increase in the tariff	10%	13.64
Reduction in project investment	10%	13.36

As demonstrated in the results presented above, the Equity IRR of the project does not surpass the benchmark considering the variation of the selected parameters by 10%. Yet, a simulation was conducted by altering the price, electricity generation and total investment in order to verify possible scenarios where the IRR would equal the benchmark. Table 9 presents the results for the price and electricity sensitivity.

Table 9 – Scenarios when IRR of the project equals the benchmark (18.54%).

	IRR %	*PRICE (BRL/MWh)*	*ELECTRICITY (MWh/yr)*	*Variation (%)*
Original	10.76	121.25	745,646	N/A
Price	18.54	155.32	745,646	28.10
Electricity	18.54	121.25	1,212,421	62.60

An increase in the price would result in an Equity IRR equal to the benchmark if readjusted to BRL155.32/MWh. This corresponds to a variation of 28.10% from the original price considered (BRL121.25/MWh). On the other hand, the Equity IRR of the project would equal the benchmark in the scenario where 1,212,421MWh/yr is exported by the plants to the grid. As per the preliminary results of the wind certification, the plants were intended to export 745,646MWh. This variation corresponds to an increase in the electricity generation equivalent to 62.60%.

The results presented above were achieved considering the plant load factor of the preliminary study conducted by Garrad Hassan, which was the most up-dated information available at the time the investment decision was made. However, the technical configuration of the plants was revised.

The final layout of the plants considers a total installed capacity equal to 162MW, while the preliminary results considered 158.4MW. However, the average plant load factor of the plants as presented in the final configuration is lower (52.33%) than the one presented in the preliminary study (53.74%). Consequently, the decrease in the plant load factor as presented in the final wind certification results in a lower level of electricity generation. In this sense, the analysis presented above can be considered conservative.

Nevertheless, a simulation was conducted considering the final plant load factor based on the final wind certification issued in November 2010. The results are presented in the table below confirming the project's additionality.

Table 10 –IRR variation considering the PLF presented in the final wind certification and the scenarios when it equals the benchmark (18.54%).

	IRR %	*PRICE (BRL/MWh)*	*ELECTRICITY† (MWh/yr)*	*Variation (%)*
Original	10.65	121.25	742,560	N/A
Price	18.54	155.93	742,560	28.60
Electricity	18.54	121.25	1,205,175	62.30

As can be noted from the results presented above, even when considering the result of the final wind certification, significant variations are required for the IRR of the project to equal the benchmark. Nevertheless, it shall be noted that these variations in price and electricity are not expected to occur as further substantiated below.

The price used in the analysis (BRL121.25/MWh) was taken from the results of the public auction conducted by the Chamber of Electrical Energy Commercialization (CCEE – *Câmara de Comercialização de Energia Elétrica*) in which the electricity to be dispatched by the plant was negotiated. According to CCEE *the criterion of the least tariff is used to define the winners of a given auction, that is, the winners of the auction shall be those bidders which offer electric power for the least price per Megawatt-hour to supply the demand envisaged by the Distributors*.

The result of a successful participation in this kind of public auction is the signature of a Power Purchase Agreement called CCEAR – Contract on Energy Commercialization in Regulated Market[24]. CCEAR's will remain fixed throughout the years, and will only be adjusted in accordance with the Amplified Consumers Price Index (from the Portuguese *Índice de Preços ao Consumidor Amipliado*), which is the official index that measures inflation in Brazil. However, the cash flow had already taken into account this price variation over the years being considered. Hence, no variation in the Equity IRR should be expected to be associated with a possible increase in the price of electricity above the one already considered.

Electricity generation is not expected to rise as the estimate is based on the guaranteed power as measured at the plant's site by an independent consultant (Garrad Hassan) at 50% probability (P50). As explained previously this range indicates that there is a 50% chance of a higher level of electricity generation by the plant. At this level, more wind is captured indicating an optimistic estimate. For reference, financing institutions consider wind measurements of 90% probability (P90) a conservative approach. Furthermore, electricity exceeding the amount that was negotiated in the auction, resulting from wind park optimization, was considered. Thus, an increase in project revenues due to an increase in electricity generation a is very unlikely.

Figures for the investment sensitivity analysis are to be disclosed during the validation. However, taking the information available from project developers at the time of the investment decision (August 2010), the Equity IRR would equal the benchmark in the scenario when total investments are reduced by 25.76%. Nevertheless, the total investment necessary to build the plant mainly results from expenses related to acquisition of equipment and civil infrastructure.

The total value of the equipment supply agreement was already available at the time the investment decision was made and is not going to be changed. Further, specifically for this project activity the project owner is planning to sign an EPC contract. This type of contract fixes the price of plant construction and any variation either in favor or against the project is attributed to the construction company. This indicates that no variation in Equity IRR could be attributed to a variation in investment costs.

Outcome

The Equity IRR of the project activity without registration as CDM project is below the sector benchmark, evidencing that project activity is not financially attractive to the investor. Thus, scenario 1 would be the most

[24] According to CCEE *the new model for the electric sector states that the commercialization of electric power is accomplished in two market ambiences: the Regulated Contracting Ambience – ACR (Ambiente de Contratação Regulada) and the Free Contracting Ambience –ACL (Ambiente de Contratação Livre). Contracting in the ACR is formalized by means of regulated, bilateral agreements, called Electric Power Commercialization Agreements within the Regulated Ambience (CCEAR – Contratos de Comercialização de*

plausible alternative to the project activity, *i.e.* the continuation of the current situation with additional electricity supplied by the Brazilian Interconnected Grid.

SATISFIED/PASS – Proceed to Step 3

Step 3. Barrier analysis

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

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

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

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

SATISFIED/PASS – Proceed to Step 4

Step 4. Common practice analysis

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

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

Based on the definition presented above, the tool provides a stepwise approach to be applied while conducting the common practice analysis 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.

Energia Elétrica no Ambiente Regulado) entered into between Selling Agents (sellers, generators, independent producers or self-producers) and Purchasing Agents (distributors) which participate of electric power purchase and sale auctions.

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

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

Two plants considered in the PDD possess 22.4 MW of installed capacity, namely Da Prata and Ventos do Nordeste Wind Power Plants. For these plants, projects between 11.2 MW and 33.6 MW of installed capacity are going to be taken into consideration (*Range 1*).

Tanque Wind Power Plant has an installed capacity of 27.2 MW. Hence, concerning the commons practice analysis for this project, plants ranging from 13.6 MW to 40.8 MW of installed capacity will be taken into consideration (*Range 2*).

The other plants considered in this CDM project - Dos Araçás, Morrão and Seraíma Wind Power Plants - have 30MW of installed capacity each. These plants will be compared against projects possessing an installed capacity between 15MW and 45MW (*Range 3*).

Finally, the operational plants with a total installed capacity similar to the total output considered in this CDM Project Activity will also be assessed. This corresponds to wind power plants with an installed capacity ranging from 81MW to 243MW (*Range 4*).

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

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

(i) Output

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

(ii) Applicable geographical area

The additionality tool states:

> *"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".*

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

The technology to be applied in the project is not country specific. Nevertheless, Brazil has an extension of 8,514,876.599 square kilometres[26] (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 climatic variations obviously have a strong influence in the technical aspects related to the implementation of wind farms since meteorological events have strong influence in the wind regime. As cited by VESELKA[27], the *climate affects all major aspects of the electric generation sector ranging from electricity generation, transmission and distribution to consumers demand for power*. Therefore, it is reasonable to assume that technology may vary considerably from location to location within the country.

According to the Brazilian Electricity Regulatory Agency all geographical regions of the country have some potential to generate electricity using wind. However the highest wind power potential is founded in the northeast region of the country, where the majority of operational projects are located (Figure 4). Nevertheless, in line with the guideline recommendations, the assessment will be conducted considering projects located in the entire country, *i.e.* Brazil.

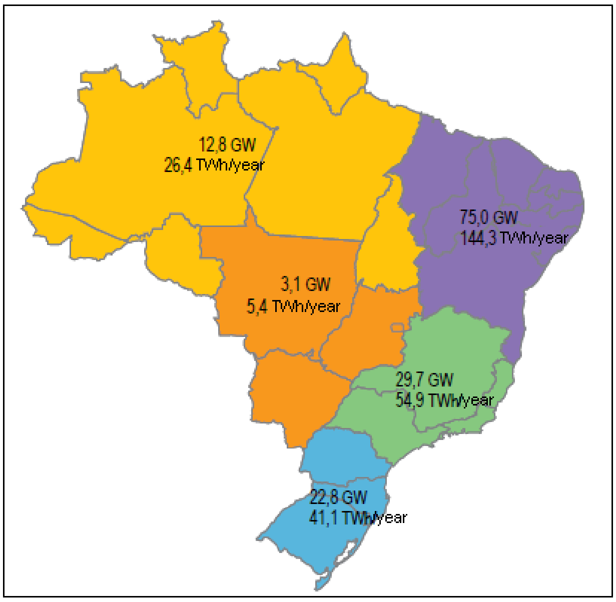

Figure 4 – Brazilian wind resource potential[28].

Project Participants researched wind farms in Brazil that became operational up to the start date of the project. The database of ANEEL (2009b)[29] was used and the list of all plants considered in the analysis was supplied to the DOE.

[26] Available at: http://www.ibge.gov.br/home/geociencias/areaterritorial/principal.shtm. Accessed on 18 April 2011.

[27] 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>.

[28] 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>. Accessed on 18 April 2011.

The result for each range described above in step 1 follows:

Range 1 and 2: The same set of plants was identified for these two ranges. Result shows 9 wind power plants considering the range identified in Step 1, have started commercial operations before the start date of the project. None benefit from CDM incentives. Therefore, $\boldsymbol{N_{all}}$ **= 9**.

Range 3: 10 wind power plants considering the range identified in Step 1, started commercial operations before the start date of the project. None benefit from CDM incentives. Therefore, $\boldsymbol{N_{all}}$ **= 10**.

Range 4: 1 wind power plant considering the range identified in Step 1, started commercial operations before the start date of the project. It doesn't benefit from CDM incentives. Therefore, $\boldsymbol{N_{all}}$ **= 1**.

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}.*

According to the methodological tool *"Demonstration and assessment of additionality"*, different technologies are ones that deliver the same output and differ from the project by at least one of the following:

(a) *Energy source:* given the particularities of wind power generation, only wind power plants are going to be considered;

(b) *Legal regulations:* Until the beginning of the 1990's, the energy sector was composed almost exclusively of state-owned companies. From 1995 onwards, due to the increase in international interest rates and the lack of state investment capacity, the government started the privatization process. However, by the end of 2000 results were still modest. Further initiatives, aiming to improve electric generation in the country, were taken from the late 1990's to 2003; however they did not attract new investment to the sector. In 2003 the recently elected government decided to fully review the electricity market institutional framework in order to boost investments in the electric energy sector. The market rules were changed and new institutions were created such as Energetic Research Company (in a free translation from the Portuguese *Empresa de Pesquisa Energética* – EPE) – an institution that would become responsible for the long term planning of the electricity sector with the role of evaluating, on a perennial basis, the safety of the supply of electric power – and Chamber for the Commercialization of Electric Power (CCEE) – an institution to manage the commercialization of electric power within the interconnected system. This new structure was approved by the House of Representatives and published in March of 2004[30]. Given the new regulatory framework and investment climate, only projects starting after March of 2004 will be considered similar to the proposed project activity.

(c) *Promotional Polices:* Alternative Electricity Sources Incentive Program (in a free translation from the Portuguese Programa de Incentivo às Fontes Alternativas de Energia Elétrica – PROINFA), created through the Law # 10,438 dated April 26th, 2002. Among others, one of the initiative's goals is to increase renewable energy sources share in the Brazilian electricity market, thus contributing to greater

[29] ANEEL (2011b). Fiscalização dos serviços de geração. Acompanhamento da expansão da oferta de geração de energia elétrica. Resumo geral do acompanhamento das usinas de geração elétrica - Versão abril 2011. Available at: http://www.aneel.gov.br/area.cfm?idArea=37&idPerfil=2. Accessed on 27 April 2011

[30] Available in Portuguese at <http://www.planalto.gov.br/CCIVIL/_Ato2004-2006/2004/Lei/L10.848.htm>. Accessed on 18 April 2011.

environmental sustainability. In order to achieve such goals, the Brazilian government has designated the federal state-owned power utility Eletrobrás (Centrais Elétricas Brasileiras S/A) to act as the primary off-taker of electric energy generated by alternative energy facilities in Brazil, by entering into long-term Power Purchase Agreements with alternative energy power producers, at a guaranteed price of at least 80% of the average energy supply tariff charged to ultimate consumers. Also, the Brazilian Decree # 5,025 dated March 30th, 20041, which regulates the Law # 10,438, states that PROINFA aims for the reduction of greenhouse gases as established by the United Nations Framework Convention on Climate Change (UNFCCC) under Kyoto Protocol, contributing to sustainable development. Therefore, the program is clearly a "Type E-" policy.

Considering the information presented above, the plants that received some kind of incentive (PROINFA and/or CDM) were identified. The database of ANEEL (2009b)[31] and UNFCCC (2009)[32] were used and a list of all plants considered in the analysis was supplied to the DOE. Amongst the plants identified in the previous step within the different ranges described, the number of plants that apply technologies different to those applied in the proposed project activity is as follows:

Range 1 and 2: From the set of plants identified, 8 wind power plants have received incentives from PROINFA (identified as a promotional policy, as explained above). Therefore, $\boldsymbol{N_{diff} = 8}$.

Range 3: From the set of plants identified, 9 wind power plants have received incentives from PROINFA (identified as a promotional policy, as explained above). Therefore, $\boldsymbol{N_{diff} = 9}$.

Range 4: From the set of plants identified, 1 wind power plant has received incentives from PROINFA (identified as a promotional policy, as explained above). Therefore, $\boldsymbol{N_{diff} = 1}$.

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 calculated factor for each one of the identified ranges is:

Range 1 and 2: $\boldsymbol{F = 1- 8/9 = 0.1}$

Range 3: $\boldsymbol{F = 1- 9/10 = 0.1}$

Range 4: $\boldsymbol{F = 1- 1/1 = 0}$

This factor represents the share of plants using a similar technology to the one used by 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.

[31] ANEEL (2011b). Fiscalização dos serviços de geração. Acompanhamento da expansão da oferta de geração de energia elétrica. Resumo geral do acompanhamento das usinas de geração elétrica - Versão abril 2011. Available at: http://www.aneel.gov.br/area.cfm?idArea=37&idPerfil=2. Accessed on 27 April 2011

[32] UNFCCC (2011). United Nations Framework Convention on Climate Change. Web-site: http://cdm.unfccc.int/Projects/Validation/index.html

As can be observed from the results presented above in Step 4, in all of the identified ranges the determined factor **F** is not greater than 0.2. Also $N_{all} - N_{diff}$ is not greater than 3 in any of the ranges. Therefore, the proposed CDM Project Activity is not a common practice.

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

Amongst the operational plants in the country, wind power projects represent only 0.81% (Figure 5). Despite the small share of electricity generated through operation of wind power plants, a common practice analysis has been conducted.

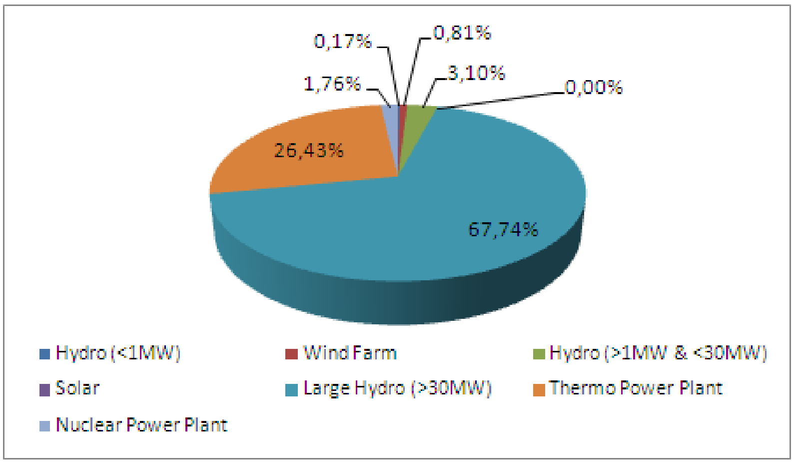

Figure 5 - Brazil's generation capacity per type of energy source.

Source: ANEEL (2011)[33]

There is a low percentage for wind energy generation and the vast majority of operational plants in the country have received some kind of incentive, as demonstrated above. Hence, this project cannot be considered common practice and therefore is not a business as usual type scenario. Further it is clear that, in the absence of the incentive created by the CDM this project would not be the most attractive scenario.

SATISFIED/PASS – Project is ADDITIONAL

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission Reductions (ER_y)

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

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

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

Where,

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

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

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

Baseline emissions (BE_y)

Baseline emissions are calculated as follows:

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

Where,

BE_y = Baseline emissions in year y (tCO_2);

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

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

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

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

Where,

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

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

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

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

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

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

Brazilian DNA published Resolution #8, issued on 26th May, 2008, defining 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.

Dispatch data analysis in not an available option for the calculation of the operating margin since it is only applicable for the *ex-post* vintage. The simple operating margin can only be used where low-cost/must-run resources[34] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term norms for hydroelectricity production. Table 11 shows the share of hydroelectricity in the total electricity production for the Brazilian interconnected system. However, the results show the non-applicability of the simple operating margin to the proposed CDM Project Activity.

Table 11 - Share of hydroelectricity generation in the Brazilian interconnected system, 2006 to 2010

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

Source: ONS / Operador Nacional do Sistema: Histórico de Geração, 2011. Available at <http://www.ons.org.br/historico/geracao_energia.aspx>).

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

The fourth alternative, an average operating margin, is an oversimplification and reflects in no way the impact of project activity on the operating margin. The use of dispatch data analysis method is only applicable to the *ex-post* vintage for determining the emission factor, which is not the vintage chosen by the project participants. Therefore, the simple adjusted operating margin will be used to determine the grid emission factor.

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

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

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

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

Where,

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year *y* (tCO_2/MWh)

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

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

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

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

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

m = All grid power units serving the grid in year *y* except low-cost/must-run power units

k = All low-cost/must run grid power units serving the grid in year *y*

y = The relevant year as per the data vintage chosen in Step 3

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

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

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

Where,

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

$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

m = All power units serving the grid in year *y* except low-cost/must-run power units

y = The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

Information used to determine this parameter was supplied by The Electric System National Operator (from the Portugues *Operador Nacional do Sistema* – ONS), which is an official source, as recommended by the tool. ONS is an entity of private right, non-profitable, created on 26 August 1998, responsible for coordinating and controlling the operation of generation and transmission facilities in the National interconnected Power System (NIPS) under supervision and regulation of the Electric Energy National Agency (ANEEL)[35].

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

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

The sample group of power units *m* used to calculate the build margin was determined following the guidance provided by the tool as further discussed in section B.6.3. below. The build margin was calculated following the same approach described above in step 4.

- **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);

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

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

w_{OM} = Weighting of operating margin emissions factor (%);

w_{BM} = Weighting of build margin emissions factor (%).

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

Project emissions (PE_y)

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

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

Where,

PE_y = Project emissions in year y (tCO_2e);

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

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

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

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

According to the methodology, only geothermal and solar thermal projects have to account 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 emissions related to the implementation of the proposed project activity are 0 tCO_2.

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

Data / Parameter:	$EF_{CO2,m,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Large amount of data. Please refer to the emission factor calculation spreadsheet which is attached to the PDD.
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the recommendation of the *"Tool to calculate the emission factor for an electricity system"*. IPCC default values are being used since this information is neither provided by fuel suppliers nor regional and/or local default values are publicly available.
Any comment:	-

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

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

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

Data / Parameter:	$EF_{grid,OM\text{-}adj,y}$
Data unit:	tCO_2/MWh
Description:	Simple adjusted operating margin CO_2 emission factor in year *y*
Source of data used:	Official publications (data from ONS), IPCC default values and default values provided by the *"Tool to calculate the emission factor for an electricity system"*
Value applied:	0.2609
Justification of the choice of data or description of measurement methods and procedures actually applied :	The *ex-ante* calculation vintage of this parameter was chosen as per the procedures of the *"Tool to calculate the emission factor for an electricity system"*.
Any comment:	For methodological choices details, please refer to section B.6.1.

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

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

Baseline emissions (BE_y)

The quantity of net electricity generated by the plants in year *y* ($EG_{faciclity,y}$, in MWh) used for the ex-ante estimative is taken from the optimized Wind Certification conducted by Garrard Hassan. Nevertheless, 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) is based on the amount of electricity to be dispatched to the grid by each plant at the Gravity Point[36] of the system. Therefore, the transmission losses have to be discounted from the estimated total electricity to be generated by the plant[37]. These losses were estimated as being equal to 2.5%.

The result for the plants is presented below in Table 12. The plants considered in this CDM Project Activity will generate 742,560MWh.

Table 12 – Net electricity generation by the wind plants of the CDM Project Activity

Wind Power Plant	**Electricity generation (MWh/year)**	**Transmission Losses (%)**	**Net electricity generation (MWh/yr)**
Da Prata	94,300	2.5	91,943
Dos Araçás	139,000	2.5	135,525
Morrão	143,700	2.5	140,108
Seraíma	146,300	2.5	142,643
Tanque	125,800	2.5	122,655
Ventos dos Nordeste	112,500	2.5	109,688
Total	**761,600**	**-**	**742,560**

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

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

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

[36] 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.*

[37] Transmission losses of the grid in 2009 were 2.44%. Source: 2009 CCEE Report, available at http://www.ccee.org.br/StaticFile/Arquivo/biblioteca_virtual/Relatorios_Publico/Anual/relatorio_anual_2009_2.pdf

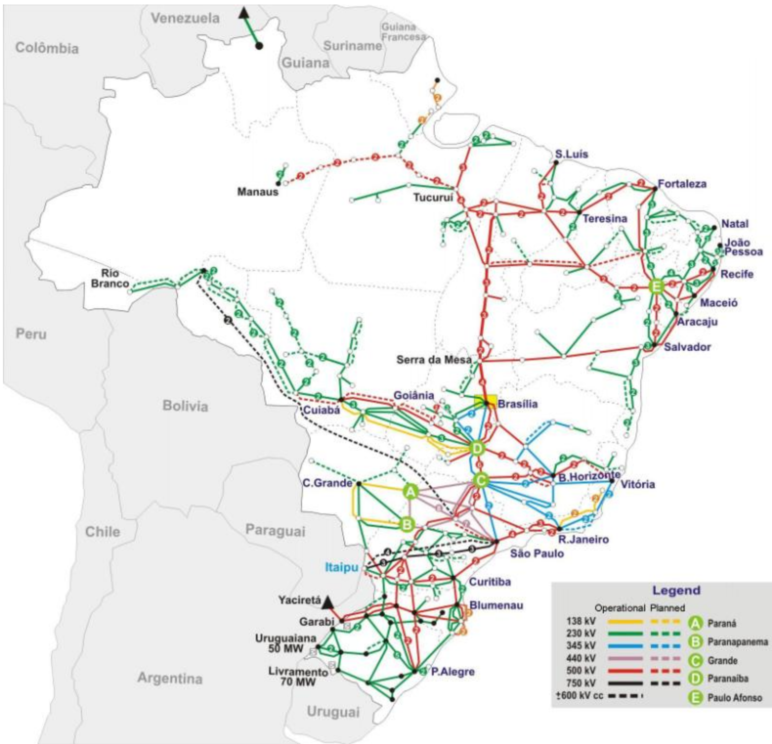

Figure 6 – Brazilian Interconnected System. (*Source:* Electric System National Operator)

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

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

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

$EF_{grid,OM\text{-}adj,y} = 0.2609\ tCO_2e/MWh$

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

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

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

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

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

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

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

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

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

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

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

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

From the results presented above, $AEG_{SET\text{-}sample\text{-}CDM}$ is lower than $0.2 \times AEG_{total}$. Then, steps (e) and (f) were applied.

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

the generation of that unit is fully included in the calculation);

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

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

The build margin was calculated following the same approach described above in Step 4, and considered the set of plants identified above. As mentioned previously, this parameter will be validated since the *ex-ante* option was chosen.

The result for the build margin emission factor is presented below.

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

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

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

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

$EF_y = 0.75 \times 0.2609 + 0.25 \times 0.1166$

$\boxed{EF_{grid,CM,y} = 0.2248\ tCO_2e/MWh}$

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

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

$EG_{PJ,y} = EG_{facility,y}$ = 742,560MWh/year

BE_y = 742,560MWh/year 0.2248tCO_2/MWh

BE_y = 166,924tCO_2

Project Emissions (PE_y)

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

PE_y = 0tCO_2e

Leakage emissions (LE_y)

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

LE_y = 0tCO_2e.

Emission reductions (ER_y)

Applying the results discussed above to Equation 1 we obtain,

$ER_y = BE_y - PE_y$

$ER_y = 166{,}924 tCO_2e$

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

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

Years*	**Estimation of project activity emissions** (tonnes of CO_2e)	**Estimation of baseline emissions** (tonnes of CO_2e)	**Estimation of leakage** (tonnes of CO_2e)	**Estimation of overall emission reductions** (tonnes of CO_2e)
Year 1	0	166,924	0	166,924
Year 2	0	166,924	0	166,924
Year 3	0	166,924	0	166,924
Year 4	0	166,924	0	166,924
Year 5	0	166,924	0	166,924
Year 6	0	166,924	0	166,924
Year 7	0	166,924	0	166,924
Total (tonnes of CO_2e)	**0**	**1,168,468**	**0**	**1,168,468**

** From September 1st of a given year up to August 31st of the subsequent year.*

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* (by Da Prata Wind Farm)
Source of data to be used:	Documented evidence from the local power utility or CCEE – Câmara de Comercialização de Energia Elétrica, a Brazilian governmental entity which monitors the quantity of electricity in the national interconnected grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	91,943
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. The monitoring of this parameter will be conducted separately for each plant. This data will be continuously measured and at least monthly recorded.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirement an extremely low level of uncertainty – 0.2 precision class). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured.
Any comment:	Since the proposed project activity is a greenfield project, as explained above in

	section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (by Dos Araçás Wind Farm)
Source of data to be used:	Documented evidence from the local power utility or CCEE – Câmara de Comercialização de Energia Elétrica, a Brazilian governmental entity which monitors the quantity of electricity in the national interconnected grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	135,525
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. The monitoring of this parameter will be conducted separately for each plant. This data will be continuously measured and at least monthly recorded.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirement an extremely low level of uncertainty – 0.2 precision class). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured.
Any comment:	Since the proposed project activity is a greenfield project, as explained above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (by Morrão Wind Farm)
Source of data to be used:	Documented evidence from the local power utility or CCEE – Câmara de Comercialização de Energia Elétrica, a Brazilian governmental entity which monitors the quantity of electricity in the national interconnected grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	140,108
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. The monitoring of this parameter will be conducted separately for each plant. This data will be continuously measured and at least monthly recorded.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirement an extremely low level of uncertainty – 0.2 precision class). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured.
Any comment:	Since the proposed project activity is a greenfield project, as explained above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline

	emissions.

Data / Parameter:	***$EG_{facility,y}$***
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (by Seraíma Wind Farm)
Source of data to be used:	Documented evidence from the local power utility or CCEE – Câmara de Comercialização de Energia Elétrica, a Brazilian governmental entity which monitors the quantity of electricity in the national interconnected grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	142,643
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. The monitoring of this parameter will be conducted separately for each plant. This data will be continuously measured and at least monthly recorded.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirement an extremely low level of uncertainty – 0.2 precision class). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured.
Any comment:	Since the proposed project activity is a greenfield project, as explained above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

Data / Parameter:	***$EG_{facility,y}$***
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (by Tanque wind Farm)
Source of data to be used:	Documented evidence from the local power utility or CCEE – Câmara de Comercialização de Energia Elétrica, a Brazilian governmental entity which monitors the quantity of electricity in the national interconnected grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	122,655
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. The monitoring of this parameter will be conducted separately for each plant. This data will be continuously measured and at least monthly recorded.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirement an extremely low level of uncertainty – 0.2 precision class). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured.
Any comment:	Since the proposed project activity is a greenfield project, as explained above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

Data / Parameter:	***$EG_{facility,y}$***
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (by Ventos do Nordeste Wind Farm)
Source of data to be used:	Documented evidence from the local power utility or CCEE – Câmara de Comercialização de Energia Elétrica, a Brazilian governmental entity which monitors the quantity of electricity in the national interconnected grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	109,688
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. The monitoring of this parameter will be conducted separately for each plant. This data will be continuously measured and at least monthly recorded.
QA/QC procedures to be applied:	Energy metering QA/QC procedures are explained in section B.7.2 (the equipments used have by legal requirement an extremely low level of uncertainty – 0.2 precision class). In addition, there will be another meter at the substation (backup) to ensure that electricity will be properly measured.
Any comment:	Since the proposed project activity is a greenfield project, as explained above in section B.6.1. this parameter corresponds to $EG_{PJ,y}$ used to determine baseline emissions.

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[38] 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[39]. CCEE is a not-for-profit, private, civil organization 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[40].

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

[38] Information available at <http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en>.
[39] Information available at <http://www.aneel.gov.br/>.
[40] Information available at <http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=25afa5c1de88a010VgnVCM100000aa01a8c0RCRD>.

permissible error) of the electricity meters to be used[41]. In addition, ONS also rules over the electricity meter calibration requirements (every two years)[42].

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

As mentioned before, CCEE makes feasible and regulates commercialization of electrical energy in Brazil. In a process named 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. In turn 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 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, reviewing of reported results/data, internal audits of GHG project compliance with operational requirements and corrective actions. Further, it is responsible for project management, as well as for the organising and training of staff in the appropriate monitoring, measurement and reporting techniques.

It is important to mention that ANEEL can visit the plant to inspect the operation and maintenance of the facilities at any time. Yet, in line with the CDM requirements, all data used to monitor the emission reductions by the proposed project activity will be kept for at least 2 years after the end of the last crediting period.

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

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

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[41] 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.

[42] 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.

Name of person/entity determining the baseline:

Company:	Ecopart Assessoria em Negócios Empresariais Ltda.
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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:

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*".

Electricity to be supplied by the plants was negotiated in the Third Reserve Energy Auction for Renewable Sources. This public tender was conducted by CCEE on 26 August 2010. Contracts derived from this auction were to be signed only after approximately 8 months subsequent to the tender. However, before entering the sale, the company had signed a MoU with the equipment supplier, which was to be valid as of the auction date if electricity from the plants was negotiated. Therefore, the date of the auction – representing the date when the contract for equipment supply took effect - will be considered as the starting date of the project, *i.e.* 26 August 2010. Before this date, neither significant expenditures were made nor were relevant contracts signed.

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

20y-0m [10]

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:

01/09/2013

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

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

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

Considering the high level of environmental impact from fossil fuelled electricity generation, the environmental impact from Wind Power Plants is considered insignificant. For this reason and in accordance with the National Environment Council (from the Portuguese CONAMA - *Conselho Nacional do Meio Ambiente*) Resolution #279, dated 27/06/2001, wind power plants must undergo a simplified environmental impact assessment in order to obtain the necessary licenses for the project.

Licenses required by the CONAMA - (Resolution #237/01[43]) are:

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

The process commences with an analysis by the local environmental department providing a simplified environmental impact assessment. The result of this assessment is the Preliminary License (LP), reflecting the local environmental agency's positive evaluation of the project. In Bahia State, where the wind farms are located, this first permit is called Localization License (LL).

[43] Available at: http://www.mma.gov.br/port/conama/res/res01/res27901.html

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

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

The plants possess the Localization License #3932, dated 06/03/2009, valid for 5 years, referring to Da Prata Wind Farm, and Localization License #4115, dated 30/07/2010, valid for 5 years, referring to Dos Araçás, Seraíma, Tanque, Morrão and Ventos do Nordeste Wind Farms.

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:

Growing global concerns regarding the sustainable use of resources has been driving demands 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 best international practices.

As mentioned in section D.1, wind power plants have to do a simplified environmental impact assessment and comply with possible demands made by the Environmental Agency in order to obtain the necessary licenses for the project. Given the project already possesses the preliminary environmental license, it can be concluded that it does not result in any significant negative trans-boundary environmental impact; otherwise the license would not have been issued by the environmental agency.

SECTION E. Stakeholders' comments

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

According to Resolution nr. 7, issued on March 5th 2008[44], 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 send invitations for comments to 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;

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

– Community associations;

– State Attorney for the Public Interest (state and federal);

The same resolution also requires that at the time these letters are sent, a version of the PDD in the local language and a declaration stating how the project contributes to the sustainable development of the country must be made available to these stakeholders at least 15 days previous to the starting of the Global Stakeholder Process (GSP). The Portuguese version of the PDD was published at the internet website <http://sites.google.com/site/consultadcp/> on 16/09/2011 which is also the date when the invitation letters were sent to the following agents:

– Federal Attorney for the Public Interest;

– State Attorney for the Public Interest of Bahia;

– Environmental Agency of Bahia (INEMA *from the Portuguese Instituto de Meio Ambiente e Recursos Hídricos*);

– Brazilian Forum of NGOs and Social Movements for Environment and Development;

– City Halls of Igaporã, Pindaí, Guanambi and Caetité;

– City Councils of Igaporã, Pindaí, Guanambi and Caetité;

– Environmental Agencies of Igaporã, Pindaí, Guanambi and Caetité;

– Community Associations of Igaporã, Pindaí, Guanambi and Caetité;

Copies of the letters and post office confirmation of receipt are available upon request and will be submitted to the DOE during the validation of the Project Activity.

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

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

This project is not a 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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