CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Rosa dos Ventos wind energy project.

Version 03

Date: 20/03/07

A.2. Description of the small-scale project activity:

The project activity is a bundling of two small scale wind energy projects gathered under the name *Rosa dos Ventos*. The CDM bundling Project is composed of the *Lagoa do Mato* wind farm (3.20 MW) and *Canoa Quebrada* wind farm (10.50 MW). The Project owner and developer is a specific purpose vehicle (SPV), *Rosa dos Ventos Ltda*, an independent energy producer so labelled within the new Brazilian electricity market scenario.

During the last decade, several studies regarding the Brazilian wind energy potential were carried out with estimations ranking between 20,000 MW to 60,000 MW. The most successful study was based on numeric modeling of surface data using *MesoMap*[1], being suitable for macro estimations on wind energy assessment (20 to 30 km^2 resolution), but proving not sufficient for areas smaller than 1 km^2 and altitudes higher than 50 meters.

From 1995 onwards, the Brazilian government has approved the installation of new wind farms, amounting more than 5,000 MW and, despite the enormous potential of the wind energy in Brazil, the installed capacity remains irrelevant, with 239,250 kW so far implemented[2] or 0.24% of the total installed capacity in Brazil.

The purpose of the project activity is to generate energy from a renewable source by placing 17 Enercon wind turbines of 800 kW nominal capacity with a total installed power of 13.60 MW, generating around 45.6 GWh per year. The bundling project is foreseen to reduce green house gases (GHG) emissions of around 12,175 tCO_2equ (tonnes of carbon dioxide equivalent) per annum between 2008 and 2014 on average.

Both wind projects are allocated under the *Proinfa* program, a governmental program created to promote the introduction of new sources of renewable energy, the development of environmentally-friendly technologies and to assist in achieving the stabilization of the anthropogenic GHG emission according to the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol.

Both wind farms will be located 170 km east of *Fortaleza*, the capital of the *Ceara* state. The project will positively reduce the energy imports to the Northeast geo-electric region from distant states, reducing the energy losses due to transportation and helping to reduce the GHG generated by the increasing thermal plants share at the current regional energy mix. Moreover the peak wind energy production occurs during the low hydro season and vice versa, complementing both sources on the regional energy scenario.

Besides, the project activity assists in the local sustainable development by reducing local air pollution, assisting on technical knowledge transfer and generating specialized and non-specialized employment

[1] *Specific software developed with the support of the New York State Energy Research and Development Authority (NYSERDA) and the US department of Energy (DoE).*

[2] *Installed capacity by sources, ANEEL(March 2007).*

during the construction and operation phase (at different levels such as wind measurement, energy services, topographic studies, geological and environmental analysis, civil works etc).

In the view of the local Stakeholders, the project activity will open up new access roads, reinforce the regional grid and decrease the need for water stock for energy use, therefore, allowing extra water supply in a region suffering from droughts and water scarcity.

A.3. Project participants:

Name of the Party involved	Private entity(ies) project participants	Party involved whishes to be considered as project participant
UK	*Carbon Capital Markets*	No
Brazil (Host Country)	*Rosa dos Ventos Ltd.*	No

The owner of the Rosa dos Ventos Wind Energy Project is *HLC Brasil*. The contact for the CDM project activity is *Ecologica Assessoria Ltda*. All contact details are included in Annex 1.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Brazil

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

Ceará state

A.4.1.3. City/Town/Community etc:

Municipality of *Aracati.*

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

Both sites for the project activity are located at 5 km distant and 170 km from *Fortaleza*, the capital of the *Ceará* state. On Table 1 is shown the coordinates and surface allocated for the wind farms. More details on the physical location are provided on Annex 5.

Wind farm site	*Canoa Quebrada*	*Lagoa do Mato*
Surface	97 Ha	196 Ha
Location	04° 32' 02''**S** 37° 41' 28''**W**	04° 35' 21'' **S** 37° 38' 15'' **W**

Table 1. ***Wind farm's physical details***

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The Project proposed classifies on the Type I- Renewable Energy Projects, category I.D- "Grid Connected Renewable Electricity Generation". The Project conforms to the project category since the project comprises energy generation based on renewable energy sources connected to the electrical grid under a Power Purchase Agreement (PPA).

Since the nominal installed capacity is below of the 15 MW, the project activity is defined under the definition of Type I, Small Scale CDM project activities given by the Annex II of Decision 17/CP.7 "Simplified modalities and procedures for small–scale clean development mechanism project activities"[3].

The technology used for the technical studies carried out comprises data geo-processing (*Topocad 4.0*), geological studies, wind energy assessment based on local software tools (*WinPro, EWDA*) as well as international recognized tools for wind energy assessment as *WAsP*. The technology for the wind turbines is based on the E-48 ENERCON technology with construction facilities in Brazil.

The project activity will optimize the use of trade winds (*aliseos)* rotating clockwise around low pressure areas coming from the Tropical Atlantic Ocean. For the project area, the measured average wind speed is around 8.47 m/s[4] with a relative distribution of the wind frequency East/Northeast at 35.33 %.

The local climatic conditions were horizontally and vertically extrapolated from the two years wind speed measurements based on local wind data and further feeding into the *WAsP*[5] software. In order to better describe local series of climatic conditions cause by the trade winds, the project developer used the *EWDA*[6] software.

In order to assess the power potential for the project activity a local Weibull distribution was modelled based on a three years measurement vintage. For the annual energy production, the turbine manufacture's power curve was used and crossed with the Weibull model.

The wind turbines used for the project activity are medium power wind turbine E-48 (three blades model with a standard rotational speed of 17.3 rpm) from ENERCON GmbH. The energy generated on each wind turbine is internally stepped up from 690 Volts through an internal transformer (Δ connection) to reach the local distribution voltage (power plant voltage) of 13.8 kV on (λ connection). A local sub-station constructed at the project premises will again steep up the voltage into the regional grid voltage (69 kV transmission line).

On table 2 to table 5, the power plant characteristics are shown.

---

3 http://cdm.unfccc.int/Reference/Documents/AnnexII

4 *Measured value at 61 meters high.*

5 *Wind Atlas Analysis and application Program (WAsP).*

6 *Eolica wind data Analysis (EWDA), version 1.0, developed for the project by the Brazilian centre of wind energy.*

Wind energy plant name	*Lagoa do Mato*	*Canoa Quebrada*
Construction start date	20/03/2007	20/03/2007
Operation start date	31/12/2007	31/12/2007
Installed power	3.20 MW	10.40 MW

Table 2.Wind energy plants

Technical Description of the Project Bundling					
Plant specifications	Wind Turbine	Rotor diameter	Hub height	Rated power/ E48	# turbines
Lagoa do Mato	Enercon E48	48 meters	75 meters	800 KW/ turbine	4
Canoa Quebrada	Enercon E48	48 meters	75 meters	800 KW/ turbine	13

Table 3.Technical description of the Project Bundling

Technical Description of the Wind Turbine				
Plant specifications	Swept area	Cut-in/out wind speed	Rated wind speed	Installed capacity
Lagoa do Mato	1,810 m^2	3/18-24 m/s	13 m/s	3.20 MW
Canoa Quebrada	1,810 m^2	3/18-24 m/s	13 m/s	10.40 MW

Table 4. Technical description of the Wind Turbines

Energy production of the Project activity		
Plant specifications	Ideal energy production	Net energy production
Lagoa do Mato	13.07 GWh/year	9,575 GWh/year
Canoa Quebrada	41.34 GWh/year	36,026 GWh/year

Table 5. Energy production of the Project activity

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Year	**Annual estimation of emission reductions in tonnes of CO_2equ**
2008 (January)	12,175
2009	12,175
2010	12,175
2011	12,175
2012	12,175
2013	12,175
2014 (December)	12,175
Total estimated reductions (tonnes of CO_2equ)	85,225
Total number of crediting years	***7***
Annual average over the crediting period of estimated reductions (tonnes of CO_2 equ)	12,175

A.4.4. Public funding of the small-scale project activity:

The Project will not receive any public funding from Parties included in Annex I.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

A proposed project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or a request for registration by another small-scale project activity:

- By the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

The project activity is the only CDM project proposed by the project developer and therefore is not part of a larger project activity, according to the definitions established on Appendix C of the **"*Simplified Modalities and Procedures for Small-Scale CDM Project activities*".**

SECTION B. Application of a baseline and monitoring methodology

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

The approved baseline methodology employed for the Project is*:* AMS I.D. '*Grid connected renewable electricity generation'*, Version 10 (December, 23 2006) from "Appendix B of the simplified modalities & procedures for small-scale CDM-project activities" and the approved consolidated baseline methodology ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" version 6 (valid from 19 May 06 onwards).The project activity relates to the sectoral scope number 1 "Renewable electricity generation for a grid".

B.2 Justification of the choice of the project category:

As per the methodology, the project category I.D. comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal, and renewable biomass that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generation unit.

The project uses renewable source of energy in form of wind to produce electricity. The total electricity production is 13.60 MW (800KW x 17) which is less than the eligibility limit of 15MW for a small-scale CDM project activity applying only to the renewable component as per the methodology.

B.3. Description of the project boundary:

The project boundary for the project activity is the Northeast sub-system that constitutes itself an energy market with its own dispatch order and reflects more realistically the integration of the project activity into the grid.

B.4. Description of baseline and its development:

The inclusion of the Project into the regional grid[7] will likely reduce the net imports from the national electric system at the project electrical system. Locally, the project activity will suppress partially the energy demand from a typical energy imports geo-electric area and therefore the project will affect the dispatch order of marginal sources (thermal power plants) within the project boundary.

The higher unit cost per MWh and the higher risk involved on the operation of the renewable energy systems (specially wind power and Photovoltaic energy[8]) has been the major barriers that kept the investors away from such technologies. The result of this is shown in the picture below, where wind energy projects accounts for a small participation in the Brazilian electric system, only 0.03% of the total installed power. Despite the great potential for such projects, at the beginning of the year 2004 only 9 small scale wind farms were in operation with an average installed power of 2.5 MW[9].

At the Northeast, the hydro power energy is mainly dispatch at the baseload due to the lower operation cost complemented by thermal generation, especially for the peak load. The increasing participation on the thermal share at the Northeast sub-system allows an optimization of the affluent natural energy available at the hydro plant that would be conservatively dispatch if no a secondary energy source (thermal generation) was in place. Moreover, the recent droughts, environmental restrictions, high

[7] *Referred as the Northeast geo-electric system. For further details on the project boundary, please refer to Section B.4*

[8] *Data source: Energy Ministry of Mines and Energy, decennial electric expansion plan, 2003-2012.*

[9] *Data source: Brazilian energy atlas, second edition.*

transmissions losses and the incremental risk associated to the firm energy delivered by existing hydro power plants has result on an increase of thermal capacity, not only at the Northeast but in Brazil as a whole.

Under a high risk power shortage scenario, the Brazilian government increased drastically the share of the thermal capacity, especially at the Northeast by means a national program to enhance the thermal energy. One of the most important issues of the thermal plan is that the distribution company has a *take-or-pay* contract with the thermal generation company. Currently up to the 23% of the thermal installed capacity at the Northeast is under this program. Additionally, in the year 2001 the Brazilian government defined a set of back up thermal units in order to cover the immediate peak energy demand to ensure a low risk operation profile for each sub-system. Actually there are around of 23 thermal generation units (709.2 MW) working at the Northeast under such conditions.

As shown at the table 6 below, the NOS (Brazilian grid operator entity) does not schedule large capacity additions on hydro power energy at the Northeast.

Northeast sub-system (MW)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
B. ESPERANÇA	225	225	225	225	225	225	225	225	225	225
BELEM	0	0	0	0	0	0	0	0	0	0
COMPL MOXOTO	4,285	4,285	4,285	4,285	4,285	4,285	4,285	4,285	4,285	4,285
GATOS 1	0	0	0	0	0	0	0	0	0	0
ITAPARICA	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
ITAPEBI	475	475	475	475	475	475	475	475	475	475
P. CAVALO1	160	160	160	160	160	160	160	160	160	160
PAO ACUCAR	0	0	0	0	0	0	0	0	0	0
PARATINGA	0	0	0	0	0	0	0	0	0	0
PEDRA BRANCA	0	0	0	0	0	0	0	0	0	0
SACOS	0	0	0	0	0	0	50	50	50	50
SOBRADINHO	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050	1,050
XINGO	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
TOTAL	**10,695**	**10,695**	**10,695**	**10,695**	**10,695**	**10,695**	**10,745**	**10,745**	**10,745**	**10,745**

Table 6. Hydro power development plans.

Under such scenario, the National electric energy agency (ANEEL) verified a low affluent hydro energy at the Northeast sub-system for the operation year 2004. In order to ensure a risk-free energy delivery at the Northeast sub-system, further thermal capacity test were carried out. The result was a lack on Natural gas for a full load operation scenario and a further decrease on 481 MW of the total thermal capacity installed.

The following thermal power plants were affected by Natural gas restrictions: *UTE Fafen, UTE Termobahia e UTE Camaçari, UTE Termoceará, UTE Fortaleza, UTE Termoacu,* and *UTE Termopernambuco.* On the table below the foresee operation for the affected thermal power plants during the period 2005/2006 (end of gas shortage) and further.

Northeast sub-system	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
CAMACARI	0	0	342	350	350	350	350	350	350	350
TERMO BAHIA	88	186	186	186	186	186	186	186	186	186
FAFEN	26	26	54	155	155	155	155	155	155	155
TERMOPERNAMBUCO	520	520	520	638	638	638	638	638	638	638

TERMOACU	0	0	0	316	316	316	316	316	316	316
TERMOCEARA	0	0	220	220	220	220	220	220	220	220
TERMOFORTALEZA	0	319	319	347	347	347	347	347	347	347
TOTAL	**634**	**1,051**	**1,641**	**2,212**	**2,212**	**2,212**	**2,212**	**2,212**	**2,212**	**2,212**

Table 7. Operation scheduled for the affected thermal power plants.

The future of the energy mix at the Northeast foresees the implementation of a gas pipeline from the South to the Northeast to be finished at the end of 2006. The *GASENE* gas pipeline will deliver more than 20 Millions Nm^3 of natural gas per day. Under such conditions is expected that the baseline generation at the Northeast will increase the thermal share in the near future.

Finally, with an annual average of energy of 45.6 GWh, the project bundling will displace around 85,225 tCO_2equ from the project boundary electric system, during the first crediting period.

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 small-scale CDM project activity:

The project will reduce anthropogenic emissions of GHG by reducing the need of net energy import to the Northeast sub-system[10]. Furthermore, the Project activity will also reduce GHG emissions by delaying the dispatch of thermal plants on the margin.

Project additionality is explained according to attachment A of the appendix B of the simplified M&P for small-scale CDM project activities[11], in particular by demonstrating the existence of investment, technology and prevailing practice barriers. The existent national policy promoting the use of renewable energy (*Proinfa* Program) is also addressed as means of attesting additional contribution to climate change mitigation and sustainable development.

The Brazilian Alternative Energy Sources Program - *Proinfa*

The wind energy projects bundled are both registered under the Brazilian Alternative Energy Sources Program (*Proinfa*). The *Proinfa* was created in 2002 by Law 10.438 with the specific purpose of promoting the use of alternative renewable energy sources (wind, biomass and small-hydro plants) and diversifying the Brazilian energy matrix. In its first phase, the *Proinfa* foresees the implementation of 3.300 MW of installed capacity, with operations beginning at latest in December 2008. The PPA (power purchase agreement) will be secured by *Centrais Elétricas Brasileiras SA – Eletrobrás* – the utility company designated to assist the Brazilian Government in achieving the National Policy's objectives.

As stated by Decree 5.025/2004[12], the *Proinfa* was designed not only to increase the participation of alternative renewable energy sources in the Brazilian energy matrix, but also to boost projects in accordance with the legal regime established by the Kyoto Protocol and the United Nations Framework Convention on Climate Change (UNFCCC), strengthening the Country's engagement in contributing to GHG emission reductions.

[10] *The Northeast sub-system is a major energy importer.*
[11] http://cdm.unfccc.int/methodologies/SSCmethodologies/AppB_SSC_%20AttachmentA.pdf.
[12] *Article 5 of Decre*e 5.025, from March 30, 2004.

The *Proinfa* program falls into national and sectorial policies Type E- as defined by the Executive Board during its 16th meeting: "national and/or sectorial policies or regulations that give positive comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies"[13].

Moreover, the Executive Board also specified that Type E- national and sectorial policies "may not be taken into account in developing a baseline scenario" when such national and sectorial policies have been implemented after the adoption of the CDM M&P in decision 17/CP17 (November 11, 2001)[14]. Accordingly, the *Proinfa*, launched in April 2002, is not considered in the baseline scenario and therefore additional as a national emission reduction initiative.

<u>Attachment A of the appendix B of the simplified M&P for small-scale CDM project activities</u>

Notwithstanding, additionality of the project activity can also be demonstrated in accordance with the attachment A of the appendix B of the simplified M&P for small-scale CDM project activities, considering the following categories of barriers:

(a) Investment barrier;

(b) Technological barriers;

(c) Prevailing practice.

(a) <u>Investment Barrier</u>

Even with the existing public subsidies offered by *Proinfa*, the development of wind energy projects in Brazil still pose several investment obstacles that must be surpassed by project developers in order to secure economic viability.

The initial investment required for the implementation of wind farms is considerably higher than what it is required for thermal plants. In addition, given the relatively short construction time and the lower energy generation cost, thermal plants represent a more attractive option for entrepreneurs when compared to alternative renewable energy sources, such as wind power.

In January 2005 the average power plant implementation cost was around 850 US$/kW for hydroelectric and 660 US$/kW for thermal[15], while the implementation cost for the *Lagoa do Mato* and *Canoa Quebrada* wind power project is estimated in 4,000 US$/kW[16].

The energy generation cost between thermal and wind power also differs quite significantly, as showed in the tables below:

Energy Generation Costs (USD/MWh) for Thermal Plants in the Northeast

Energy Generation Costs (USD/MWh)	
Thermal Power Plants (NE)	**2004**
FAFEN	31
TERMOBAHIA	37.87
CAMAÇARI	57

[13] *http://cdm.unfccc.int/EB/Meetings/016/eb16repan3.pdf.*
[14] *http://cdm.unfccc.int/EB/Meetings/016/eb16repan3.pdf.*
[15] *Mercados de Energia/PSR Consultoria, March 2005.*
[16] *Financial data from the project developer is available under request.*

MPX	36
TERMOFORTALEZA	25.3
TERMOPERNAMBUCO	17.3
Source: Energy Plan 2004, NOS.	

Table 8. Energy generation costs

There are two main aspects which affect the cost of electricity generated from wind, and therefore its final price:

- Technical factors, such as wind speed and the nature of the turbines.
- The financial perspective of those that commission the projects, (what rate of return is required on the capital, amortization and the length of time over which the capital has to be repaid).

For the *Rosa dos Ventos* wind energy project, the generation Costs (USD/MWh) will be directly related to the technical O&M cost and the financial cost associated to the project.

Regarding the technical factors, the measured capacity factor for the area (the *Ceará s*tate) where the project will be implemented is of 35%, which has become a standard value. Under such perspective is reasonable to present a financial plan for the project activity based on conservatory premises of capacity factor calculated upon standard values rather than the estimated values used on the Table 5.

At the table 9 below the costs are detailed.

Unit		Estimated *(RS/MWh)*	Estimated *(USD/MWh)*
Financial cost	Amortization + Financial Cost (interest)	128.67	59
Administration cost	Land (rental value)	4.4	1.94
	Administration staff	13.86	6.44
Delivery cost	Wheeling fee	22.64	10.53
Technical cost	O&M activities	21.89	10.18
TOTAL		**190.8**	**88.73**

Table 9. Energy generation costs (1 USD = 2.15 RS).

As shown at the table 9, the cost of generation is much higher when comparing with the generation cost from other energy sources, which in practice results in wind energy being far from competitive in the current Brazilian energy scenario.

<u>Other Investment Barriers.</u>

Also, the limitations of the existent surface model to define wind energy potential result in uncertainty about the energy density for the project site and therefore the annual energy output. The two to three years local measurement proved not to be sufficient for the project developers in Brazil. Consequently, there is a 50% probability on having a deviation on the energy output from the energy expected, resulting in a major barrier for commercial investments.

Equally troublesome to investors and project developers is that, according to the *Proinfa* regime and the PPA model established, *Eletrobrás* is only required to secure the payment of a monthly revenue corresponding to 70% of the contracted energy, leaving to the energy producer further uncertainties over its expected monthly turnover.

Wind energy projects often deal with extra financial hurdles that come with the need for technology transfer and specialized services, such as lack of local qualified personnel, foreign equipment acquisition and associated currency instability risks. Not rarely project developers need also to account for royalties due in relation to the technology or know-how employed.

The 220 MW total installed capacity ceiling established per State by the *Proinfa* program also curbs any scale economy for project developers. In that sense, States with a larger capacity of wind energy supply such as Ceará and Rio Grande do Norte are in significant disadvantage comparatively to other States in Brazil, which decreases the financial attractiveness of the Proinfa projects in such States, resulting on another financial barrier for the investor.

The additional finance from the CDM was therefore vital to the Project Developer's decision to undertake the project and invest in a more environmentally-friendly technology for energy generation. The revenues derived from the CERs of the project activity will serve the purpose of alleviating the investment risks highlighted above.

(b) Technological Barriers

For the development of wind based technologies in Brazil several technical barriers must be faced. For instance, technical limitations imposed to the electrical grid by a fluctuating feed drastically changes grid requirements and grid management. For the local electric network, additional new fluctuating sources to the grid also poses limitations on conducting several megawatts produced at high winds into the local weak electric infrastructure.

In addition, according to the *Proinfa* program, at least 60% of the services and equipment employed in the wind farms must be purchased domestically. This condition creates an additional obstacle since the internal market is currently composed by a small number of equipment/technology suppliers, circumstance that often compels project developers to purchase lower efficiency turbines, thereby, reducing project efficiency and profitability[17].

As a result, Project Investors are seeking for additional assurance for the technical and financial success of the project through the CDM.

(c) Prevailing Practice

In spite of the public subsidies given by *Proinfa*, usual practices in Brazil exclude wind power mainly due to associated technological risks, large initial capital investment and high energy generation costs.

The marginalization of wind power technology in the Brazilian overall energy scenario is conclusive. Until 2004 only 25MW of wind capacity had been installed in Brazil[18]. According to the National Energy Balance, wind energy accounted for only 0.017% (61 GWh) of the total energy generation in 2004 (349,593 GWh) [19].

As a primary energy source, wind energy is not significant enough to be considered in the internal energy offer for 2004[20], as showed in Figure 1:

[17] *The Rosa dos Ventos Wind Energy Project makes use of a 800kW/turbine, while in regular market conditions it could be applying a higher efficiency turbine, which would improve earning power, capacity and optimize equipment allocation.*
[18] *"Altas Brasileiro de Energia", 2nd Edition, 2004.*
[19] *National Energy Balance 2005, Ministry of Mines and Energy.*
[20] *National Energy Balance 2005, Ministry of Mines and Energy.*

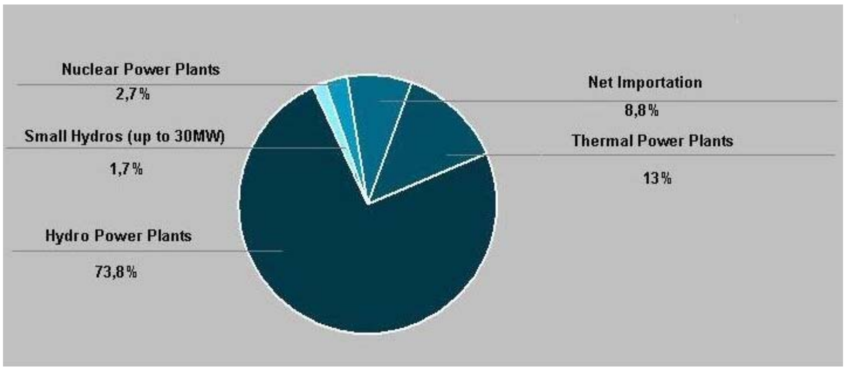

Figure 1: Internal energy offer (Source: Ministry of Mines and Energy)

In the Northeast region particularly, where hydro and biomass sources are not abundant, thermal plants are often the first option for investors. As discussed in the *Investment Barrier* section above, thermal power plants present lower implementation and energy related costs in comparison with wind power development costs. In that sense, the revenues (selling of CERs) arising from the CDM represent an additional form of financial viability to the proposed project.

Nevertheless, the *Rosa dos Ventos* wind energy project as stated previously is not the business-as-usual scenario in a country where large hydro power plant and thermal fossil fuel projects are preferable.

Despite the fact that the wind energy project is a clean source of energy generation it can be concluded that the CDM project is not financially attractive when comparing to other power generation sources presented at the Northeast.

Therefore the registration of the project as a CDM project will help to overcome the natural barriers presented here at the PDD; e.g. the decrease of the risk associated to the amount of energy delivered, to incentive the local industry for wind energy and develop a know-how on wind energy assessment.

Finally the registration of the proposed project activity will have a strong impact on the development of wind energy projects by encourage other project developers to implement similar projects based on the CERs as financial incentive for such project type.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline

For the baseline determination, project participants shall only account CO2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity. Therefore, the **annual baseline emissions (*BE_y*)** use the Combined Margin (CM) approach to calculate the baseline scenario emissions. The annual baseline emissions (BE_y) is the result of the annual net electricity generated from the Project (EG_y) times the yearly baseline emission factor (EF_y).

$$BE_y = EG_y * EF_y \quad \textit{Equation 1}$$

EG_y *(MWh/year)* = The generation of the project activity.

$EF_y(tCO_2MWh)$= Weighted average emissions per electricity unit for the Northeast system.

From ACM0002 baseline methodology establishes the baseline emission factor (EF_y) based on the combined margin (*CM*) approach, consisting of the combination of operating margin (*OM*) and build margin (*BM*) factors according to the following three steps:

- **STEP 1 –** Calculate the operating margin emission factor(s), based on one of the following methods:
  - Simple operating margin;
  - Simple adjusted operating margin;
  - Dispatch data analysis operating margin;
  - Average operating margin.

Dispatch data analysis should be the first methodological choice, however these data are not available in Brazil. Therefore, for the project activity the simple adjusted OM method is used for the calculations. The simple adjusted operating margin emission factor ($EF_{OM,\ adjusted,y}$ in tCO_2/MWh) is a variation on the simple operating margin, where the power sources (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (*j*):

$$EF_{OM,\ Simple\ Adjusted,\ y} = (1-\lambda_y)\cdot\frac{\sum_{i,j} F_{i,j,y}\cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \cdot \frac{\sum_{i,k} F_{i,k,y}\cdot COEF_{i.k}}{\sum_k GEN_{k,y}} \qquad \textbf{Equation 2}$$

Where:

- λ_y is the share of hours in year *y,* for which low-cost/must-run sources are on the margin.
- $\sum_{i,j} F_{i,j,y}$ *i*s the amount of fuel *i* (mass or volume unit) consumed by relevant power sources *j*
- $COEF_{i,j}$ is the CO_2e coefficient of fuel *i* (tCO_2e/mass or volume unit of the fuel), taking into account the carbon dioxide equivalent emission potential of the fuels used by relevant power sources *j* (analogous for sources *k*) and the percent oxidation of the fuel in year(s); and
- $\sum_j GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j* (analogous for sources *k*).

For the project activity, the low operating cost and must run resources typically include large hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. Therefore the emission factor for low-cost/must-run resources can reasonably be: EF $OM_{,y} = 0$.

The non-low-cost/must run resources for the project activity are thermal power plants burning coal, fuel oil, natural gas and diesel oil. These plants result in non-balanced emissions of greenhouse gases.

The most recent numbers for the interconnected S-SE-CO system were obtained from the Brazilian national dispatch center (*ONS*) in the form of daily consolidated reports. The load duration curves and energy demand for the project boundary of the project activity are given in Annex 3.

In order to calculate the Operating Margin (OM) emission factor, the project boundary has to be modelled with electricity imports from other geo-electric systems to describe, as close as possible, the baseline situation. The ideal approach is to determine the impact of electricity imports on the operation margin “merit order”. This approach is true when dispatch merit of the external grid power sources are clearly known based on reliable data[21], if not the average emission rate of the exporting grid will be used otherwise.

Electricity transferred from external sub-systems (North and South/Southeast/Central sub-systems) are considered electricity imports when the energy transfer occurs from the connected electricity system to the project electricity system and electricity transferred to connected electricity systems are defined as electricity exports.

The methodology for the emissions factor calculation is based on the *Simple Adjusted OM*. In order to define plot the Load Duration Curve, data were sourced from the ONS for the years 2003, 2004 and 2005. In order to separate low-cost/must-run power sources and other power sources, the ANEEL (National electricity agency) database was consulted (see annex 3 for more information).

- **STEP 2.** Calculate the Build Margin emission factor (*EFBM,y*) as the generation-weighted average emission factor (tCO2/MWh) of a sample of power plants *m*.

The Build Margin emission factor will be estimated ex-ante. The sample group *m* consists of either the five power plants that have been built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Power plant capacity additions registered as CDM project activities should be excluded from the sample group *m*.

The **Build Margin (*EF_BM*$_y$)** is calculated as follows:

$$EF\_BM_y = \frac{\sum_{i,m} F_{i,m,y} . COEF_{i,m}}{\sum_m GEN_{m,y}} \qquad \textbf{Equation 3}$$

Where:
$F_{i\,mj,\,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by a sample of power plants *m*[22] in year(s) *y*,
$COEF_{i,m}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *m* and the percent oxidation of the fuel in year(s) *y*, and
$GEN_{m,y}$ is the electricity (MWh) delivered to the grid by plants *m*.

The build margin approach aims to make a "best guess" on the type of power generation facility that would have otherwise been built, in the absence of the GHG mitigation project. As noted by *Kartha et al.*,[23] even in well-planned electricity systems, it is not easy to determine the timing and type of new electricity capacity additions.

For the purpose of determining the Build Margin (BM) emission factor, the spatial extent is limited to the project boundary, not being included imports, since recent or likely future additions to the transmission

---

21 *The grid operator (ONS) must provide enough data to identify such marginal plant(s).*

22 *The sample group m consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation(in MWh) and that have been built most recently.*

23 *Martina Bosi: Road-Testing Baselines for Greenhouse Gas Mitigation Projects in the Electric Power Sector (OECD and IEA Information Paper COM/ENV/EPOC/IEA/SLT(2002)6). Outubro de 2002. Disponível em: http://www.oecd.org/dataoecd/45/54/2766208.pdf*

capacity are not meaningful regarding the amount of imported electricity vs. generated energy at the project electricity system.

For the project activity, the *electricity imports* from the North sub-system are based on hydro power generation operating at the baseload. The previous means that the implementation of the project activity will not have any displacement effect on the energy provided by this low-cost/ must-run source that will anyway operate at the baseload

- **STEP 3.** The **baseline emission factor (EF_y)** is a weighted average of the EF_OM_y (operating margin carbon emissions factor) and the EF_BM_y (build margin carbon emissions factor).

$EF_y = (\omega_{BM} * EF\_BM_y) + (\omega_{OM} * EF\_OM_y)$	***Equation 4***

Where:

$\omega_{OM} = 0.75$ and $\omega_{BM} = 0.25$, according to methodology ACM 0002.

Leakage

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, fuel handling (extraction, processing, and transport), and land inundation. No sources of leakage were identified for the project activity.

Project Emissions

There is no project emissions predicted for the project activity.

Emission Reductions

The emission reduction *ERy* by the project activity during a given year *y* is the difference between baseline emissions (BE_y), project emissions (PE_y), as follows:

$ER_y = BE_y - PE_y - Ly$	***Equation 5***

For the project activity, $PE_y = Ly = 0$

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

Data / Parameter:	**EF**
Data unit:	tCO_2equ/MWh
Description:	CO_2 emission factor for the grid
Source of data used:	Data obtained from ONS (National Operator System) and calculated according to methodology ACM0002 (version 06). The emissions factors of Revised IPCC Guidelines for National Greenhouse Gas Inventories were used.
Value applied:	0.267
Justification of the choice of data or description of measurement methods and procedures actually	The baseline emission factor (EF_y) is calculated as the weighted average of the combination of operating margin (*OM*) and build margin (*BM*) factors. It will be calculated *ex-ante.*

applied :	

Data / Parameter:	**$F_{i,y}$**
Data unit:	Mass or volume
Description:	Fuel quantity
Source of data used:	Obtained from SIESE 2002, 2003, 2004. (National Energy statistics).
Value applied:	Variable
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

Data / Parameter:	**$COEF_i$**
Data unit:	tCO_2 /mass
Description:	CO_2 emission coefficient of each fuel type i
Source of data used:	Revised IPCC Guidelines for National Greenhouse gas Inventories 1996
Value applied:	Variable
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

Data / Parameter:	**$GEN_{j/k/n,y}$**
Data unit:	MWh/y
Description:	Electricity generation of each power source / plant j, k or n
Source of data used:	Obtained from CCEE (Monthly Energy Generation).
Value applied:	Variable
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002

Data / Parameter:	**Plant name**
Data unit:	Text
Description:	Identification of power source / plant for the OM
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Please refer to table 16 and17 provided in annex 3.
Justification of the choice of data or description of measurement methods	Mandatory under methodology ACM0002

and procedures actually applied :	

Data / Parameter:	**Plant name**
Data unit:	Text
Description:	Identification of power source/ plant for the BM
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Please see table 11
Justification of the choice of data or description of measurement methods and procedures actually applied :	Mandatory under methodology ACM0002. Comprise the five most recently built plants, which comprise the larger annual generation compared to the recently built 20%.

Data / Parameter:	$\mathbf{GEN}_{j,k,ll,y\ imports}$
Data unit:	MWh
Description:	Amount of electricity imported
Source of data used:	Obtained from ONS (National Operator System)
Value applied:	Variable.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Madatory under methodology ACM0002

B.6.3 Ex-ante calculation of emission reductions:

The operating margin for the project boundary is calculated *ex- ante* using the full generation-weighted average for the most recent 3 years. The amount of fuel consumption for thermal generation for the project boundary is available for 2003, 2004 and 2005 (last year availability of the data). The average *EF_OMy* for the project activity is 0.198 (kg CO_2equ/kWh). At the table 10 below the values are given.

Data Vintage	EF_Omy (kg CO_2equ/kWh)
2003	0.13
2004	0.28
2005	0.19

Table 10. Values of EF_OMy

For the project activity the most recent data based on historical capacity additions are provided through the *ONS*. The values for energy generation are defined through the wholesale electricity market operator (*CCEE*) and where data are not available, default values for the Brazilian grid system are defined[24].

The list of the power plants is given below (Table 11):

[24] *OECD and IEA Information Paper, Bossi et al (2002).*

OPERATION	Generation Type	Power Plant	Install Power	Observations
Jan.03	Combined Cycle	MPX TERMOCEARA	220 MW	Natural Gas fuel
Feb.03	Combined Cycle	TERMOFORTALEZA	294 MW	Natural Gas fuel
30/01/2004	Open cycle	CHESF/CAMACARI	280 MW	Natural Gas fuel
09/02/2004	Open cycle	TERMOBAHIA	180 MW	Natural Gas fuel
15/05/2004	Combined Cycle	TERMOPERNAMBUCO	532.74 MW	Natural Gas fuel
15/05/2004	Open cycle	FAFEN ENERGIA	18.2 MW	Natural Gas fuel
16/12/2004	Hydro	PEDRA DO CAVALO	162 MW	Registered as CDM project

Table11. Power plants on the Build Margin.

As defined at the ACM0002 baseline methodology, the power plant capacity additions registered as CDM project activities should be excluded from the sample group, so does the *Pedra do Cavalo* power plant. Using equation 3, EF_BM_y for the selected plants is 0.477.

Finally, the baseline emission factor *EFy* is calculated as the weighted average of the Operating Margin emission factor (*EF_OMy*) and the Build Margin emission factor *(EF_BMy):*

$$\mathbf{EF_y} = (\omega_{BM} * EF\_BM_y) + (\omega_{OM} * EF\_OM_y) = 0.267$$

In order to ensure conservativeness of the *BM* calculation a sensitivity analysis was conducted. There two main detected sources of uncertainty, there are the quantity of natural gas consumed by power utility (Nm3/kWh) and the energy imports from external electrical subsystems (GWh/year).

First, the consumption rate of the power plant was analysed. The consumption rate represents the average quantity of fuel consumed or expended to be consumed when generating a kWh of energy and expressed in quantities of Nm3/kWh. This parameter depends upon the technology of the power plant and economic factors through the capacity factor and the dispatch model of the power plant and therefore the uncertainty level is high. For the project activity the consumption rate was tested for a range of +30% (decrease of the fuel consumption performance) and -30% (increase of the fuel consumption performance) based on the BM value calculated for the project activity. The goal is to analyse if a small change in the consumption rate results in relatively large changes in the outcome (emission reductions).

The base case represents a total emissions reduction on the base case of 85,225 tCO2equ/year. If changes on the consumption rate applies, the BM will be affected on the way that the set of power plants defined at the build margin will have different values on the kg of CO2 emitted and therefore will directly affect to the BM value.

Changes of the *consumption rate* ranging between -30% were applied. The previous means a power plant scenario with an extremely high efficient consumption rate (up to 0.17 Nm3/kWh) based on a combined cycle and vapour turbines working for the cogeneration process. This is not the situation for the existing power plants where the real scenario represents a mix of open cycle power plants (based on Natural gas), such as *Fafen* power plant (0.362 Nm3/kWh), *Camaçari* and *Termobahia* power plants with a higher consumption rate[25] (0.356 Nm3/kWh).

[25] *Eletrobrás; specific fuel consumption rate for the Camaçari and Termobahia power plants can be consulted under the following link: http://www.eletrobras.gov.br/mostra_arquivo.asp?id=http://www.eletrobras.gov.br/downloads/EM_Atuacao_CCC/consumo_especifico_2004.pdf&tipo=ccc)*

Nevertheless, regarding the extreme case, which is the BAT[26] for combine cycle (-17% or consumption efficiency of 198 m^3/MWh). The previous argument shows a reduction on 26,000 tCO2equ/year. It seems reasonable to think that this extreme variation of the consumption rate may not affect substantially the outcome.

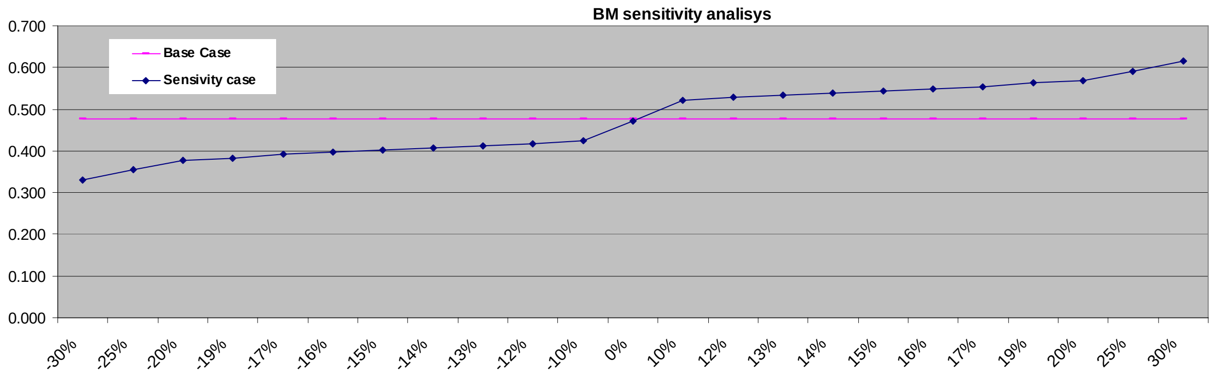

Figure 2. BM variation sensitivity analysis.

Taking on account the mix of thermal power plants (regarding the technology of generation) the consumption rate established for the project activity chosen is quite conservative (0.24 Nm3/kWh). Consumption rates below this value are not on consonance with the standard values for energy generation worldwide.

Consumption rate (Nm3/kWh)	BM factor	Δ base case
0.24	0.470	0%
0.22	0.430	-10%
0.21	0.420	-12%
0.21	0.410	-13%
0.20	0.400	-15%
0.20	0.390	-17%
0.19	0.380	-20%
0.18	0.350	-25%
0.17	0.330	-30%

Table 12. Consumption rate and its impact on the BM factor.

The second parameter to analyse is the change on the imported energy (GWh/year) from other electrical sub-systems. The benchmark for the deviation was the increased value (%) of imported energy from the Central/Central West and South-East sub-system into the Northeast sub-system. Further analysis shows little or depreciable impact on the normal operation (and therefore the OM value) and can be concluded that the variation on the value does not decrease significantly the value output for the emissions factor.

Another important parameter to analyse is the lambda factor that represents the percentage of the time that the energy generation from the *LCMRs* (Low cost must run sources) are on the margin. An increase on the value of the lambda represents a decrease of the hours that the *LCMRs* are on the margin. Proportionately, a decrease of the λ value would mean that the share of thermal energy will increase and therefore less generation will be generated by the *LCMRs.*

[26] *The NCVi for the Brazilian gas is 35,588 kJ/m3 or 0.10 m3/kWh. Therefore to consider 0.198 m3/kWh as BAT may be considered quite conservative.*

The case above presented is unlikely to happen since the thermal share at the Northeast will increase on new capacity in order to balance the energy system. The expected *GASENE*[27] gas network will likely impact on the generation cost of the thermal power plants based on combined cycle, so it is reasonable to think that the (1-λ) value will increase (an not decrease) as the thermal generation will increase in the near future.

It can therefore be concluded from the sensitivity analysis that the *BM* value is as robust, stable and accurate to consider the calculated *BM* value conservative enough.
Finally, the emission reductions are achieved through the Combined Margin emission factor and the generated energy by the project, resulting in 12,175 tCO2e.

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

Year	Estimation of project activity emissions	Estimation of baseline emissions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of overall emissions reductions
2008 (January)	0	12,175	0	12,175
2009	0	12,175	0	12,175
2010	0	12,175	0	12,175
2011	0	12,175	0	12,175
2012	0	12,175	0	12,175
2013	0	12,175	0	12,175
2014 (December)	0	12,175	0	12,175
Total (tonnes of CO2e)	0	85,225	0	85,225

Table 13. Summary of ex ante estimated emissions.

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)	
Data / Parameter:	EG_y
Data unit:	KWh
Description:	Electricity Generation delivered to grid by *Lagoa do Mato* and *Canoa Quebrada* wind farm
Source of data to be used:	Measured by project developer.
Value of data	45,601,000 KWh
Description of measurement methods and procedures to be applied:	It will be recorded hourly and archived in electronic and paper format during the crediting period and two years after.
QA/QC procedures to	Data will be monitored and registered by the project developer. Sales invoices

[27] *The future of the energy mix at the Northeast foresees the implementation of a gas pipeline from the South to the Northeast to be finished at the end of 2006.*

be applied:	will ensure consistency for the collected data as well the records from ONS.
Any comment:	This amount of energy was initially granted by ANEEL according to the first feasibility studies, however this value was recalculated in order to become this amount of energy closer to reality and a higher value was found. A new ANEEL Resolution or Dispatch is expected to officially announce this number.

B.7.2 Description of the monitoring plan:

The party responsible for implementing the monitoring plan shall be the owner company, *Rosa dos Ventos Ltda*. The project developer will also be responsible for developing the forms and registration formats for data collection and further classification. For this purpose the authority for the registration, monitoring, measurement and reporting will be the Engineer *Armando Abreu.*

The operational structure will be based on a continuous monitoring of the *Net energy generation* delivered to the grid by means electronic and analogical meters from both on site and placed at the grid connection point. The further collection, data analysis and records' handling will be managed by the wind farm management staff and records kept on electronic format. Moreover, the procedures for internal review of reported results will be periodically (weekly) checked against the NOS (National Operator System) daily records on the metered energy for the wind farms. The procedure defined for an eventual failure on the metering equipment will follow the NOS own records for the D.3.1 and D.3.2 indicators.

The management structure will rely on the local technicians with a weekly defined operation schedule. The project operator will be responsible for the training of monitoring and operation personnel with the help of equipment manufactures. The technical team will manage the monitoring, the quality control and quality assessment procedures and the different auditory carried out at the project premises.

The maintenance structure will be based on the internal O&M (Operation and Maintenance) staff to guarantee the perfect working of the meters. The maintenance structure will also ensure that the monitoring equipment is perfectly equilibrated based on the INMETRO standards (Brazilian institute for metrology and calibration).

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

The baseline study and monitoring methodology for the project activity was completed on 07/03/2007 by *Ecologica Assessoria*, which is not a project participant. Below, the name of person and entity determining the baseline:

Name of person/Organization	Project Participant
Alejandro Bango Ecologica Assessoria Ltda. São Paulo, Brazil. Tel: +55 11 5083 3252 Fax: +55 11 5083 8442 e-mail: alejandro@ecologica.ws	NO
Thiago Chagas *Ecologica Assessoria Ltda* *São Paulo*, Brazil. Tel: +55 11 5083 3252 Fax: +55 11 5083 8442 e-mail: thiago@ecologica.ws	NO

WWW: www.ecologica.ws	

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:

Wind Energy Plant	*Lagoa do Mato*	*Canoa Quebrada*
Starting date of the activity	20/03/2007	20/03/2007

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

21y - 0m

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

The CDM project activity will use a renewable crediting period.

C.2.1. Renewable crediting period

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

Wind energy plant name	*Lagoa do Mato*	*Canoa Quebrada*
Starting date	01/01/2008	01/01/2008

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. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Wind power is one of the cleanest sources of renewable energy, with no associated emissions and waste products. The *Rosa dos Ventos* Wind Energy Project will output an expected amount of 45.6 GWh per year, producing energy without pollution and leading to a reduction in the emission of carbon dioxide, nitrogen oxide and sulphur dioxide.

The National Environmental Policy (*PNMA*), instituted by the Law 6.938/81, has the purpose of preservation, improvement and recovery of the environmental quality, with the intention to assure conditions to the social-economic development and the protection to human dignity in the country. The *PNMA* requires previous environmental licenses for the assessment of environmental impacts, and/or other activities that uses environmental resources such as construction, installation and potentially polluting activities or able to cause environmental degradation.

The process of environmental licensing starts with a previous analyses (preliminary studies) of the department of the local environment agency. Later, the project developer prepares an Environmental Impact Assessment (*EIA*) or similar studies. The result of this assessment is the Preliminary License (*Licença Prévia* or *LP*), that reflects the positive understanding of the project environmental concepts by the local or federal ambient agency. In order to get the Installation License (*Licença de Instalação* or *LAI*) it is necessary to present some additional information of the previous analyses; a simplified new assessment and the Environmental Management Plan (*PBA*), in accordance with the specified environmental conditions on the *LP*. The Operating License (*Licença de Operação* or *LO*) authorizes the activity operation after the verification of the attendance of all previous conditions.

The Environmental Impact Assessment (EIA) foresees in total 154 environmental impacts, being 99 (64,3%) positive and 55 (35,7%) adverse impacts. The EIA endorses, in its conclusion, the prevalent favorable aspects of promoting the wind energy potential as a means of boosting local economic growth by creating new investment opportunities, securing energy supply stability and promoting the use of clean and renewable technology.

Some of the impacts are discussed below:

a. Dust emissions and Noise

Low intensity noise can be generated in the implementation phase by the use and carrying of heavy equipments and the presence of workers. On the other hand, the advanced technology of the wind turbines prevent from any significant noise impact.

b. Vibrations

Vibrations sources such as building machines and vehicles will be restricted to the working area.

c. Visual impacts

The wind farm will not interfere significantly in the landscape and can also become an additional factor for touristy attraction.

d. Land issues

The Project area is not current used or economically explored and the installation of a wind farm will not interfere in the daily use of the land. The Project also takes into account the land owner profitability in relation to the land appreciation.

No major topographic changes are expected, since most of the area is flat. Access to the surface of any surrounding dunes will be limited in order to minimize leveling and cuts.

e. Flora and Fauna

The Project will not interfere in the land fauna behavior and changes are expected only during land clearance for access roads and tower's construction, being therefore restricted to a small and specific area. Environmental compensation measures will be taken to recover any natural losses and endeavor to enhance local biodiversity.

Moreover, the studies show that bird's migratory paths will not be affected by the Project.

d. Social Impacts

The social impacts of the Project will be mainly positive impacts. It is expected to generate new business and services in the region, attract other enterprises which demand steady energy supply, develop new infrastructure in the area, including access roads and communication, as well as provide employment during implementation and operation phases.

Tthe authorization from *ANEEL* for *Canoa Quebrada* and *Lagoa do Mato* Wind Power Plant were respectively made by means of *ANEEL* Dispatch n. 971 of August 5 2005 and *ANEEL* Dispatch 479 of April 13, 2005.

The LAI for *Canoa Quebrada* was granted by State Environment Superintendence (*SEMACE*) in March 2, 2006, under n. 37/2006, valid until February 20, 2008. The LAI n. 50/2006[28] for Lagoa do Mato was expedited in August 16, 2006 by the same institution, valid up to August 15, 2008. The LO will be required when the project start the activities and its approval is expected since all the conditions from LAI are being accomplished.

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:

No significant negative impacts applicable.

[28] The LAI authorizes the exploitation of 27 MW from *Lagoa do Mato* Wind Farm, which is the capacity initially authorized by ANEEL. However the PPA signed by *Rosa dos Ventos Ltd* and *ELETROBRAS* refers to only 3.23 MW.

SECTION E. Stakeholders' comments

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

According to the Resolution number 1 of the Brazilian Inter-Ministerial Commission on Climate Change[29], invitations for comments by local stakeholders are required by the Brazilian Designated National Authority (DNA) as part of the procedures for analyzing CDM projects and issuing letters of approval.

The DNA required project participants to communicate with the public through letters, to be sent inviting for comments to:

- The Brazilian national NGO's forum.

- The local attorneys' and prosecutors' agency.

- The municipality's chamber (mayor and assembly men).

- State's and municipal's environmental authorities.

- Local communities' associations.

As defined by the Designated National Authority (DNA), the project developer sent information letters to the key institutions, describing the major aspects of the implementation and operation of the proposed project. The project participant should leave 30 days opened for comments. The letters were distributed by*Rosa dos Ventos Ltd*. to key institutions (see table 14, below).

During this time, a copy of the letter were opened for public comments in English and Portuguese versions. The letters were sent in the beginning of February 2006. No comment was received.

E.2. Summary of the comments received:

No comment was received.

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

Not applicable.

[29] Issued on December 2nd of the 2003, decree from July 7th 1999.

Name of the Institution	Type of Entity	Address	Phone / Fax	Contact Point	E-mail
Instituto de Desenvolvimento Sustentável e Energias Renováveis-IDER	Non-Governmental Organisation	Júlio Siqueira St, 581 - Dionísio Torres CEP: 60.130-090 Fortaleza/CE	Fone: (85) 3247-6506	Armando Abreu – Eng. Elet.– Dir. Fin. Jörgdieter Anhalt – Eng. Mec.- Dir. Exec.	ider@matrix.com.br
Núcleo de Ensino e Pesquisa Aplicada – NEPA	Non-Governmental Organisation	2326, Monsenhor Furtado St. , Bela Vista CEP 60.441-750 Fortaleza/CE	(85) 3482-0621 (85) 3842-2377 (85) 9997-0321	Sr. Moura	nepa-ce@terra.com.br
Brazilian Forum of NGOs	Association of NGOs	SCLN 210 Block C Room 102 CEP 70856-530 Brasília DF	(61) 3340-0741	--	forumbr@tba.com.br
Public Attorney's Office - State of Ceará.	Public	1100, Assunção, José Bonifácio, CEP 60.050.011 Fortaleza – Ceará	(85) 3452-3763	Raimundo Batista de Oliviera (Environment Office)	batista@mp.ce.gov.br
Public Attorney's Office - State of Ceará.	Public	1100, Assunção, José Bonifácio, CEP 60.050.011 Fortaleza – Ceará	(85) 3452-3763	Verônica Maria Martins Telles (Local Attorney)	vmartinstelles@bol.com.br
Environment Secretariat – State of Ceará (SEMACE).	Public	1400, Jaime Benévolo, Bairro de Fátima, Fortaleza – Ceará	(85)3101-5521	Romeu Aldiguero de Arruda Coelho - Superintendente	romeuarruda@semace.ce.gov.br
Aracati City Hall	Public	1146, Santos Dumont, CEP 62.800.000 Aracati – Ceará	(88) 3446-2400	Expedito Ferreira da Costa (Maior)	aracati@aracati.ce.gov.br
Aracati City Council	Public	448, Cel. Alexanzeto, Centro CEP 62.800.000 Aracati – CE	(88) 3421-1144 (88) 3421-2435	Naselma Ferreira Porto	
Environment and Tourism Secretariat – Municipality of Aracati.	Public	352, Santos Dumont St, CEP 62.800.000 Aracati – Ceará	(88) 3446-2451	Waldelanda Ramos (Secretary General)	waldelanda@aracati.ce.gov.br

Table 14. Participants entities.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Rosa dos Ventos Ltd.
Street/P.O.Box:	Avenida Senador Virgílio Távora, 1701 sala 1305
City:	Fortaleza
State/Region:	Ceará
Postfix/ZIP:	60170-250
Country:	Brazil
Telephone:	+55 (85) 3452 7331 /
FAX:	+55 (85) 3224 3850
E-Mail:	aferreira@hlcbrasil.com.br
Title:	Director
Salutation:	Mr.
Last Name:	Ferreira
Middle Name:	Almeida
First Name:	Armando
Department:	Administration
Mobile:	+55 (85) 9991 8015
Direct FAX:	+55 (85) 3224 3850
Direct tel:	+55 (85) 3452 7331 / (11)32876277 / (21) 424 4098
Personal E-Mail:	aferreira@hlcbrasil.com.br

Organization:	Carbon Capital Markets
Street/P.O.Box:	Level 3, 15 Berkeley Street
City:	London
State/Region:	--
Postfix/ZIP:	W1J 8DY
Country:	United Kingdom
Telephone:	+44 207 317 6200
FAX:	+44 207 317 6201
E-Mail:	info@carboncapitalmarkets.com
Title:	Head of Trading
Salutation:	Mr.
Last Name:	Maltby
First Name:	Reuben
Department:	Trading
Mobile:	+44 77 9563 0861
Direct FAX:	+44 207 317 6201
Direct tel:	+44 207 317 6200
Personal E-Mail:	reuben.maltby@carboncapitalmarkets.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable.

Annex 3

BASELINE INFORMATION

Below, the graphs representing the duration load curve and the energy demand for 2003, 2004 and 2005. Data were sourced directly from the *NOS* (National operator system) for the project electrical system and project boundary (North/ Northeast system).

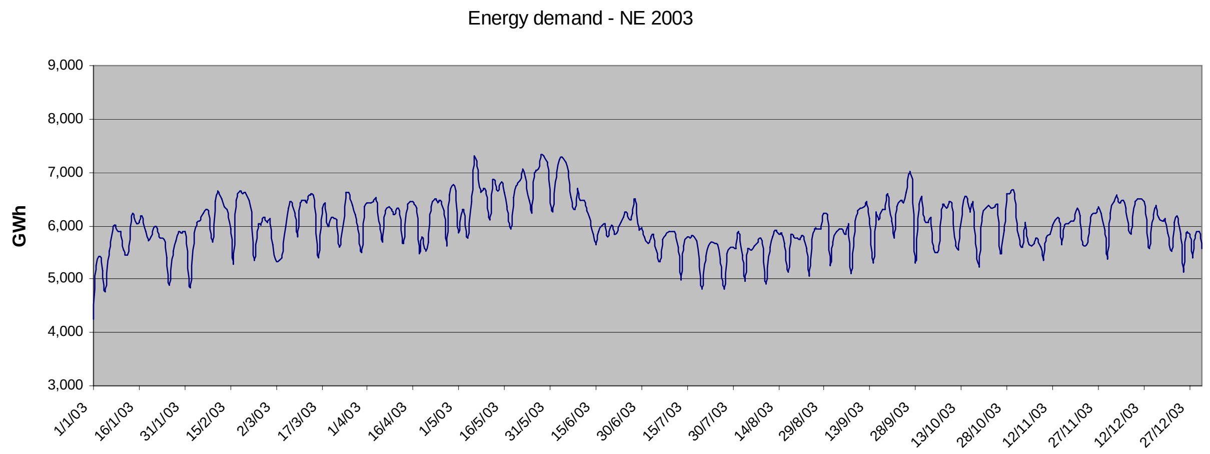

Figure 3. Energy demand for the Northeast in 2003.

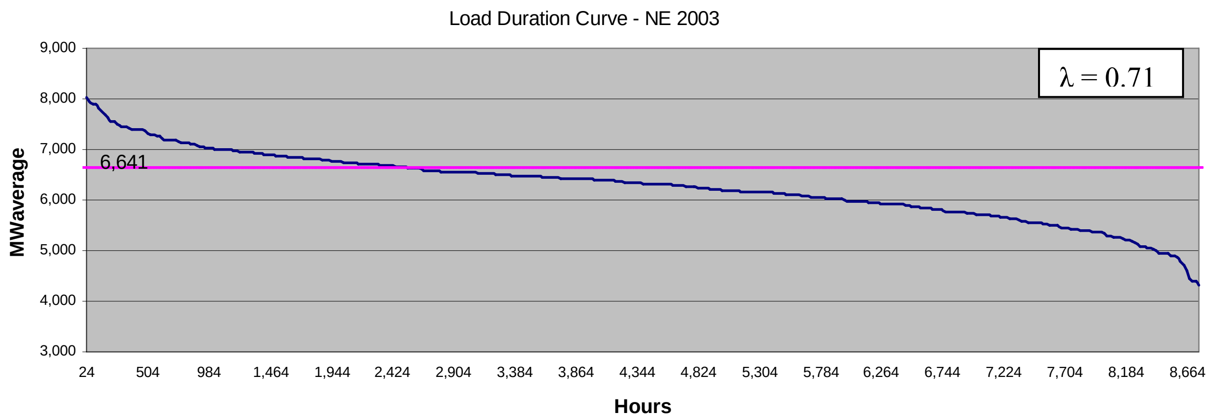

Figure 4 Load duration curve for the Northeast in 2003.

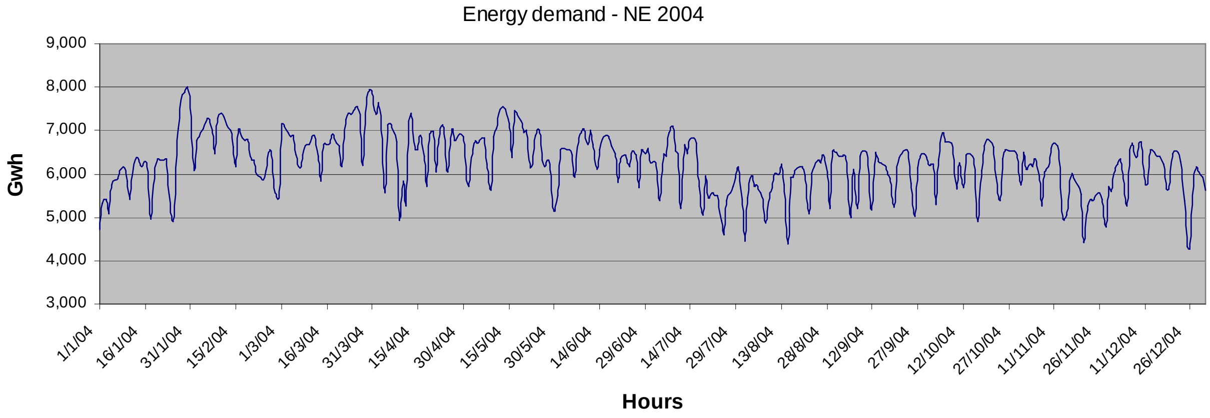

Figure 5. Energy demand for the Northeast in 2004.

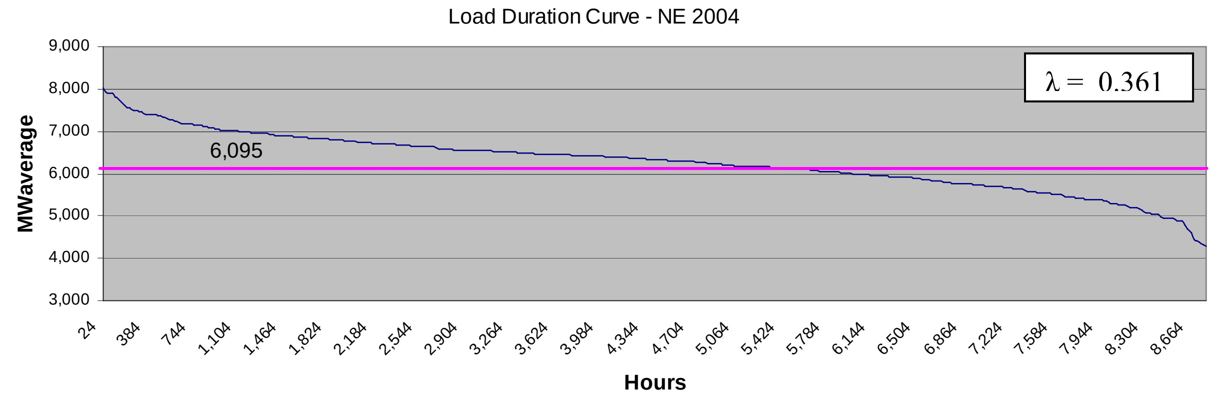

Figure 6. Load duration curve for the Northeast in 2004.

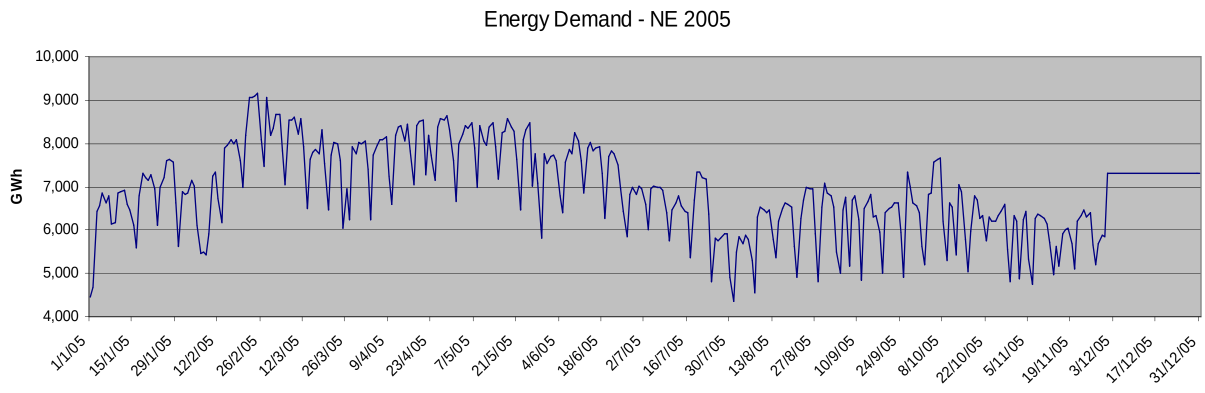

Figure 7. Energy demand for the Northeast in 2005.

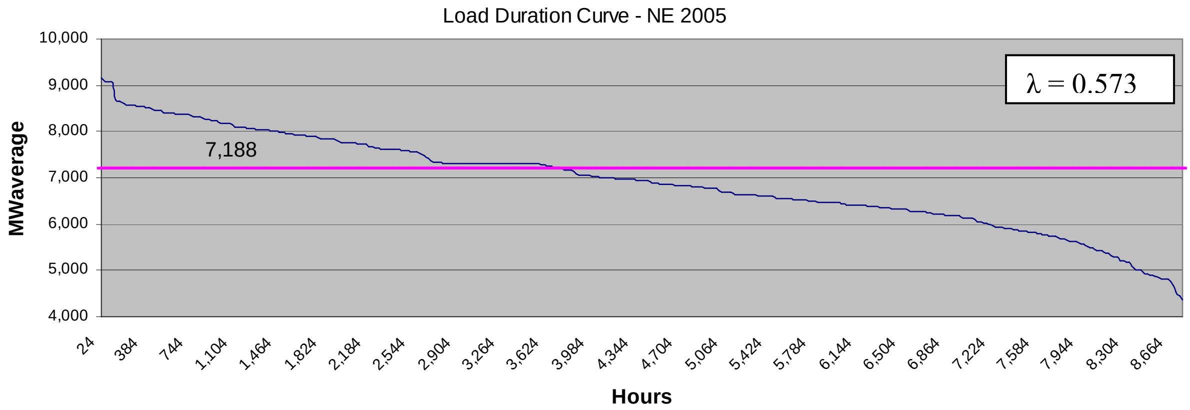

Figure 8.Load duration curve for the Northeast in 2005.

The table below represents the lead time values agreed for new capacity additions used at the baseline weighting values estimated. The assumptions are currently used in the US government's energy modelling. These are consistent with the coal and gas numbers from the OECD/IEA report, and include lead time estimates for other electric generating technologies. An assumption of three or four years would appear to be reasonable for many fossil and renewable generating technologies.

Technology	Lead time (in years)
Coal	4
Natural Gas (CC)	3
Combustion	2
Nuclear	6
Wind	3
Biomass	4

Table 15. Lead time estimation for electric generating technologies.

(*Source: OECD/IEA report: Projected Cost of Generating Electricity)*

At the definition of the baseline, the set of power plants (low cost/must run resources) are analysed as well those power plants non-low cost/must run power plants. The table below shows the installed capacity for the hydro power plants within the project boundary of the project activity.

Hydro Power Plant	Installed Power 2006 (kW)	Municipality	Installed Power 2003 (kW)	Installed Power 2004 (kW)	Installed Power 2005 (kW)
Alto Fêmeas I	10,649	São Desidério - BA	10,649	10,649	10,649
Boa Esperança	237,300	Guadalupe - PI	237,300	237,300	237,300
Funil	30,000	Ubatã - BA	30,000	30,000	30,000
Luiz Gonzaga	1,479,600	Glória - BA	1,479,600	1,479,600	1,479,600
Moxotó	400,000	Delmiro Gouveia	400,000	400,000	400,000
Paulo Afonso I	180,001	Paulo Afonso - BA	180,001	180,001	180,001
Paulo Afonso II	443,000	Paulo Afonso - BA	443,000	443,000	443,000
Paulo Afonso III	794,200	Paulo Afonso - BA	794,200	794,200	794,200

Paulo Afonso IV	2,462,400	Paulo Afonso - BA	2,462,400	2,462,400	2,462,400
Pedra	20,007	Jequié - BA	20,007	20,007	20,007
Presidente Goulart	8,000	Correntina – BA	8,000	8,000	8,000
Sobradinho	1,050,300	Juazeiro – BA	1,050,300	1,050,300	1,050,300
Tucuruí I e II	6.870.000	Tucuruí – PA	4,950,000	5,700,000	6,825,000
Xingó	3,162,000	Piranhas – AL	3,162,000	3,162,000	3,162,000
Itapebi	450,000	Itapebi – BA	450,000	450,000	450,000
Pedra do Cavalo	162,000	Cachoeira – BA	0	0	162,000
TOTAL (MW)			**15,690 MW**	**16,440 MW**	**17,727 MW**

Table 16. Installed capacity of the hydro power plants.

The table below shows the installed capacity for the ***thermal based power plants*** within the project boundary of the project activity.

Thermal Power Plant	Fuel type	Installed Power 2003 (kW)	Installed Power 2004 (kW)	Installed Power 2005 (kW)	Installed Power 2006 (kW)
Altos	Diesel Oil	13,120	13,120	13,120	13,120
Aracati	Diesel Oil	11,480	11,480	11,480	11,480
Baturité	Diesel Oil	11,480	11,480	11,480	11,480
Camaçari	Natural Gas	315,500	327,000	346,803	346,803
Camaçari (I and II)	Natural Gas	64,000	64,000	138,020	138,020
Campo Maior	Diesel Oil	13,120	13,120	13,120	13,120
Carrapicho Gebra	Diesel Oil	19,200	19,200	19,200	19,200
Caucaia	Diesel Oil	14,760	14,760	14,760	14,760
Copene	Natural Gas	250,400	250,400	250,400	250,400
Crato	Diesel Oil	13,120	13,120	13,120	13,120
Kaiser Pacatuba	Natural Gas	5,552	5,552	5,552	5,552
Enguia Pecém	Diesel Oil	14,760	14,760	14,760	14,760
Iguatu	Diesel Oil	14,760	14,760	14,760	14,760
Juazeiro do Norte	Diesel Oil	14,760	14,760	14,760	14,760
Lagarto Gebra	Diesel Oil	14,880	14,880	14,880	14,880
Marambaia	Diesel Oil	13,120	13,120	13,120	13,120
Marituba Gebra	Diesel Oil	16,000	16,000	16,000	16,000
Nazária	Diesel Oil	13,120	13,120	13,120	13,120
Peri Peri Gebra	Diesel Oil	16,000	16,000	16,000	16,000
Cloroquímico Gebra	Diesel Oil	16,000	16,000	16,000	16,000
Potiguar	Diesel Oil	52,800	52,800	52,800	52,800
Rio Largo Brasympe	Diesel Oil	177,120	177,120	177,120	177,120
Termo Toalia	Natural Gas	5,680	5,680	5,680	5,680
Termocabo	Natural Gas	48,000	48,000	48,000	48,000
Termoceará	Natural Gas	220,000	220,000	220,000	220,000
Bahia I – Camaçari	Diesel Oil	31,800	31,800	31,800	31,800
Jardim Brasympe	Diesel Oil	63,960	63,960	63,960	63,960

Petrolina	Diesel Oil	136,200	136,200	136,200	136,200
Tambaqui	Diesel Oil	162,338	162,338	83,280	83,280
Fortaleza	Natural Gas	0	319,000	319,000	346,630
Termobahia Fase I	Natural Gas	0	185,891	185,891	185,891
Termopernambuco	Natural Gas	0	532,756	532,756	532,755.70
TOTAL (MW)			**15,690 MW**	**16,440 MW**	**17,727 MW**

Table 17. Installed capacity of the thermal power plants.

Annex 4

MONITORING INFORMATION

The Monitoring plan is based on the approved monitoring methodology ACM0002, “Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources”. The monitoring methodology applies to grid-connected renewable power generation project activities such as electricity capacity additions from wind energy sources.

1. Monitoring Process

The monitoring plan provides a set of procedures for continuous monitoring of the electricity generation of the project activity that is exported to the grid and measured by means of a kWh-meter. The monitoring methodology schedules a continuous screening of the defined values and the further storage on electronic format. (spreadsheet).

The project developer is the only responsible for the operation, direct monitoring and data registration. Also the project developer will ensure enough human and material resources for the accomplishment of the activities within the monitoring plan.

2. Emissions reduction calculation process

The main data needed to recalculate the operating margin emission factor are based on the *simple adjusted OM* from the approved baseline methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”

The main data needed to recalculate the build margin emission factor are also consistent with the approved baseline methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”.

Annex 5

DETAIL OF PHYSICAL LOCATION, INCLUDING INFORMATION ALLOWING THE UNIQUE IDENTIFICATION OF THE PROJECT ACTIVITY

Figure 9. Physical location of the CEARA state (Northeast Brazil) and detail of the bundling project

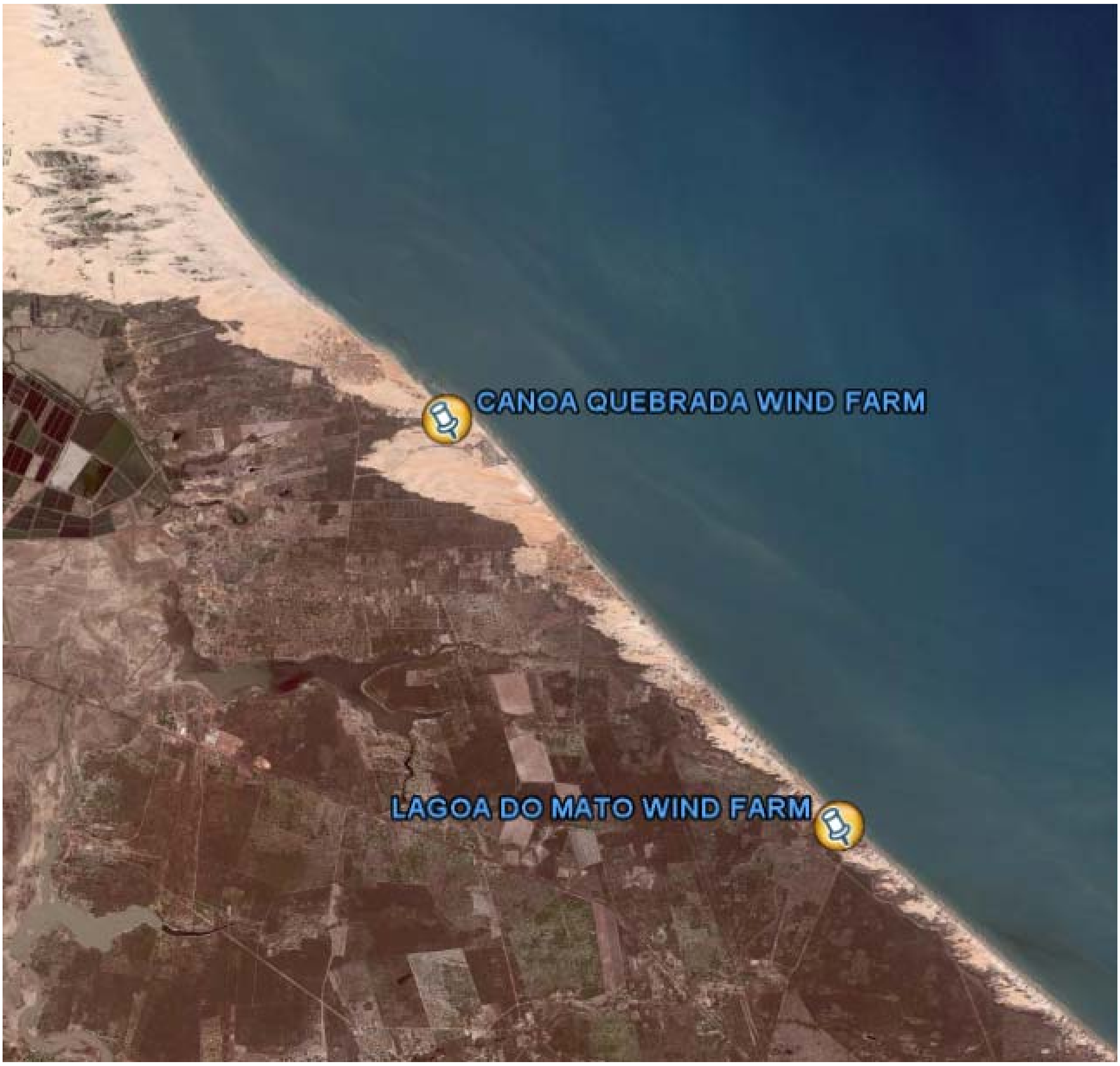

Figure 10. Physical location of the Lagoa do Mato and Canoa Quebrada wind farm