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: Curva dos Ventos Wind Farms
Version 01
December 20, 2011

A.2. Description of the project activity:

The Project "Curva dos Ventos Wind Farms" (hereinafter referred to as the project activity or the project) consists of two wind-powered electricity generation facilities called Joana and Emiliana. They will be located in the rural areas of the municipalities of Igaporã and Caetité in the State of Bahia, Brazil. The two wind farms participated in the 12th New Energy Auction carried out by the National Electric Power Agency (ANEEL) and were approved to sign an energy sales agreement with the Chamber of Electrical Energy Commercialization (CCEE).

The projects will be owned and operated by individual subsidiaries of Enel Brasil Participações Ltda (hereinafter referred to as the Project Proponent):

- Enel Green Power Joana Eólica S.A.
- Enel Green Power Emiliana Eólica S.A.

A set of wind turbines with horizontal axis will be installed to generate electricity. The two winds farms will have an installed capacity of 28.2 MW each, with a total capacity of 56.4 MW for this CDM project. The project is connected through a substation by a 230 kV transmission line to the National Interconnected System (SIN[1]). The output of electricity is expected to be 232,227 megawatt-hours (MWh) per year.

The projects will be developed in areas with agricultural activities and natural vegetation consisting mainly of shrubbery. The wind turbines will be located on land leased to the project proponent by several land owners.

The electricity generated by the project will be delivered to the SIN. It will help to reduce thermal power generation in the SIN by providing renewable energy to the grid. Thus, it will contribute to sustainability by increasing the share of renewable energy and reducing GHG emissions. The expected average annual emission reductions are 92,125 tCO_2 during a renewable 7-years crediting period. Specifically, wind power has a very low environmental footprint, compared to other alternatives.

The project will contribute to the region's sustainable development in the following ways:

- The project will decrease emissions of sulphur oxides (SO_x), nitrogen oxides (NO_x), carbon monoxide, particulate matter, other pollutants, as well as carbon dioxide associated with the combustion of fossil fuels.
- The project will decrease the use of water associated with the generation of electricity from steam-cycle power plants.

[1] in Portuguese: Sistema Interligado Nacional

- The project will reduce the dependence on fossil fuels, which are non-renewable and limited in supply.
- During construction, the project will employ approximately 200 workers. To the extent practical, these jobs will be filled by local residents.
- During operation, approximately 15 full time operation and maintenance positions will be created by the project.

The project will provide additional income to the landowners on whose land the wind turbines will be installed and will also provide significant tax revenues to the local municipalities, thereby supporting the rural economy.

A.3. Project participants:

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 wishes to be considered as project participant (Yes/No)
Brazil (host)	Enel Brasil Participações Ltda	No
Brazil (host)	Enel Green Power Joana Eólica S.A.	No
Brazil (host)	Enel Green Power Emiliana Eólica S.A.	No

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.:

State of Bahia

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

The project is located in the municipalities of Igaporã and Caetité.

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

The geographical coordinates of the project are:

Joana: 13°54'25.21"S 42°36'54.12"W
Emiliana: 13°55'39.81"S 42°37'49.70"W

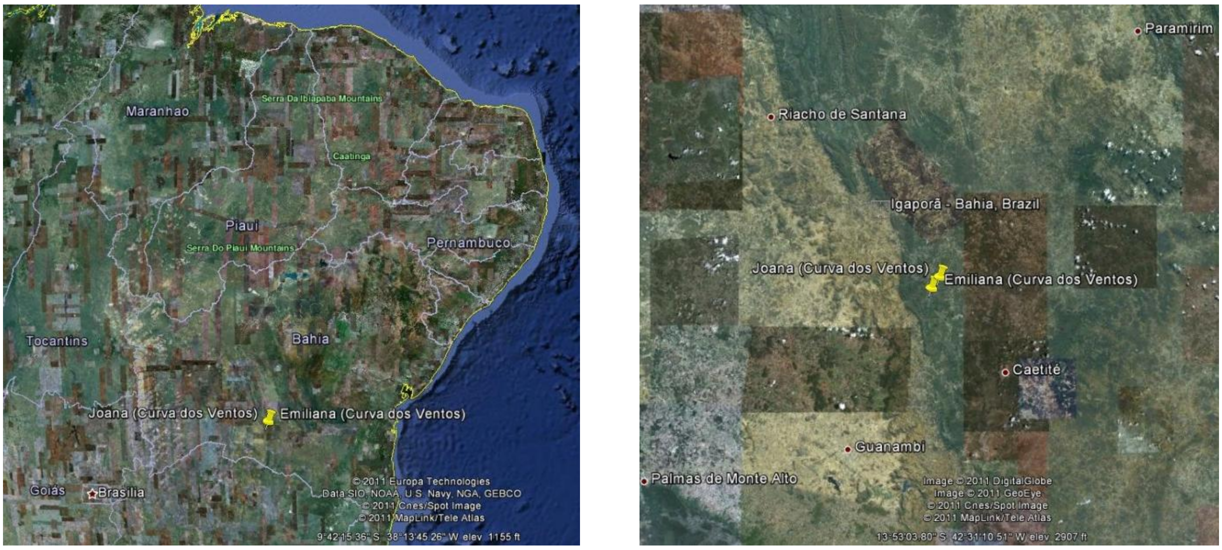


Figure 1: Maps of project location of the Curva dos Ventos Wind Farms (source: Google Earth).

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

The project activity is included in Scope 1, Energy Industries (renewable sources).

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

The purpose of the proposed project activity is to generate renewable energy from wind power. The electricity generated by the project will be delivered to the SIN. It will help to reduce thermal power generation in the SIN by providing renewable energy to the grid.

Scenario prior to the project

Before the implementation of the project activity, no power plant is installed at the project site. The energy that would be generated by the project currently is dispatched by other power plants that are connected to the national grid, and that include fossil fuel power plants. Therefore, the wind farm will contribute to reducing emissions from those power plants. The emissions that are reduced are determined in accordance with the combined margin CO_2 emission factor based on the *Tool to calculate the emission factor for an electricity system (version 2.2.0)* (see section B.6.).

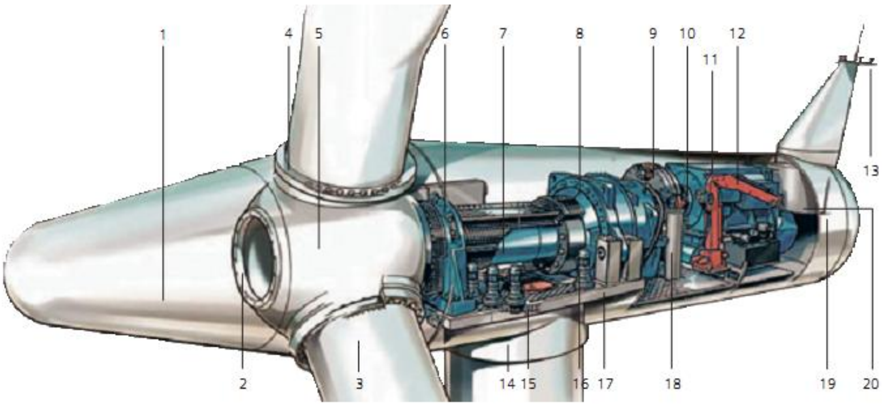
Scope of activities that are being implemented within the project activity

A set of horizontal-axis wind turbines will be used to generate electricity from the kinetic power of the wind. The project activity will include 24 wind turbines with a total capacity of 56.4 MW for the whole CDM project: 12 turbines in Joana (28.2 MW) and 12 turbines in Emiliana (28.2 MW).

Table 1 shows the specifications of the turbines used in the project activity.

Table 1. Specification of the SWT-2.35-108 turbines.

Rotor	
Diameter	108 m
Swept area	9,144 m2
Rotor speed	6-16 rpm
Power regulation	Pitch regulation with variable speed
Blade length	52.6 m
Generator	
Type	Asynchronous
Nominal power	2,300 kW
Voltage	690 V
Tower	
Type	Cylindrical and/or tapered tubular
Hub height	80 m or site-specific
Operational data	
Cut-in wind speed	3-4 m/s
Rated power at	11-12 m/s
Cut-out wind speed	25 m/s



1. Spinner
2. Spinner bracket
3. Blade
4. Pitch bearing
5. Rotor hub
6. Main bearing
7. Main shaft
8. Gearbox
9. Brake disc
10. Coupling
11. Generator
12. Service crane
13. Meteorolog. sensors
14. Tower
15. Yaw ring
16. Yaw gear
17. Nacelle bedplate
18. Oil filter
19. Canopy
20. Generator fan

Figure 2. Arrangement of the SWT-2.35-108 turbines.

The wind turbines have a generation voltage of 690 V, which is stepped up to 34,5 kV trough a transformer located at the base of each turbine. The project will be connected through a substation by a 230 kV transmission line to the National Interconnected System (SIN[2]).

[2] in Portuguese: Sistema Interligado Nacional

Since wind power industry is pretty young, no exact specifications are given by turbine providers. Any of the wind turbines are assumed to have a technical lifetime of 20 years, which is an industry wide used value and corresponds to the time of the power purchase agreement of the project.

The total project is expected to generate approximately 232,227 MWh of clean renewable electricity per year.

Table 2. Annual generation of the project activity and each individual power plant.

Power plant	Generation [MWh/yr]
Joana	119,013
Emiliana	113,214
TOTAL	232,227

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

Table 3: Estimated emission reductions during the first crediting period

Year	Estimate of emission reductions (tonnes of CO_2e)
2014	92,125
2015	92,125
2016	92,125
2017	92,125
2018	92,125
2019	92,125
2020	92,125
Total estimated reductions over the crediting period	**644,873**
Total number of crediting years	**7**
Annual average of estimated emission reductions (tCO_2e)	**92,125**

A.4.5. Public funding of the project activity:

The project does not involve any public funding.

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:

The project activity is developed in accordance with the approved consolidated baseline and monitoring methodology ACM0002 *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"* (version 12.1.0).

According to the methodology, the identification of the baseline scenario and the demonstration of additionality shall be assessed by applying the latest versions of the:

"*Tool for the demonstration and assessment of additionality*" (version 05.2).

The emission factor of the relevant power-grid is determined based on the procedures of the

"Tool to calculate the emission factor for an electricity system" (version 2.2.0).

Moreover, the following guidelines are applied:

- *"Guidelines for Reporting and Validation of Plant Load Factors"* (version 1) as per the Annex 11 of EB 48 report.
- "*Guidelines on the assessment of investment analysis*" (version 5) as per the Annex 5 of EB 62 report.
- "*Guidelines on Common Practice*" (version 1.0) as per the Annex 12 of EB 63 report.

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

The approved methodology ACM0002 "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources"* (version 12.1.0) 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).

For this project, option (a) applies since a new wind power plant is installed at a site where no other renewable power plant operated before.

In the following it is explained how the individual applicability criteria from ACM0002 (version 12.1.0) are met:

- *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 consists of the installation and operation of two grid-connected wind power facilities with an installed capacity of 28.2 MW each, and a total of 56.4 MW.

- *In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter* $EG_{PJ,y}$*): 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 expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;*

  This condition is not relevant since the project activity does not involve any capacity additions, retrofit or replacements, but consists of the installation of a completely new power plant.

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

  This condition is not relevant for the project, which is a wind power plant.

The methodology is not applicable to the following:

- *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;*

  The proposed project activity does not involve switching from fossil fuels to renewable energy at the site of the project activity.

- *Biomass fired power plants;*

  The proposed project activity does not involve biomass fired power plants.

- *Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4* W/m^2*.*

  The project is not a hydro power plant.

- *In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".*

  This condition is not relevant since the project activity does not involve any capacity additions, retrofit or replacements, but consists of the installation of a completely new power plant.

Thus, the methodology is applicable to the proposed project activity.

The "*Tool to calculate the emission factor for an electricity system"* (version 2.2.0) is applied to calculate baseline emissions for a project activity that substitutes grid electricity. Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, there are specific conditions that should be met. Since the electricity system affected by the proposed project activity includes only grid connected power plants, no specific conditions should be assessed. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country, which for the proposed project activity is not the case.

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

The spatial extent of the project boundary includes the two wind farms Joana and Emiliana and all power plants connected physically to the electricity system that the CDM project power plant is connected to, which in this case is the National Interconnected System (SIN).

Figure 3 shows the schematic diagram of the project activity under consideration:

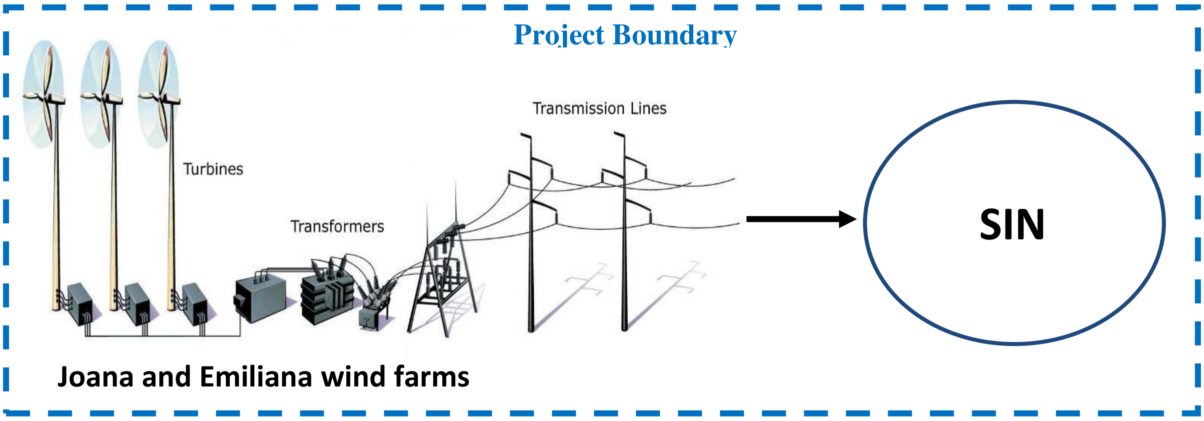


Figure 3: Diagram of project activity

The geographic and boundary of the Brazilian National Interconnected Grid (SIN) is shown in Figure 4, and relevant information about the characteristics and operation is available.

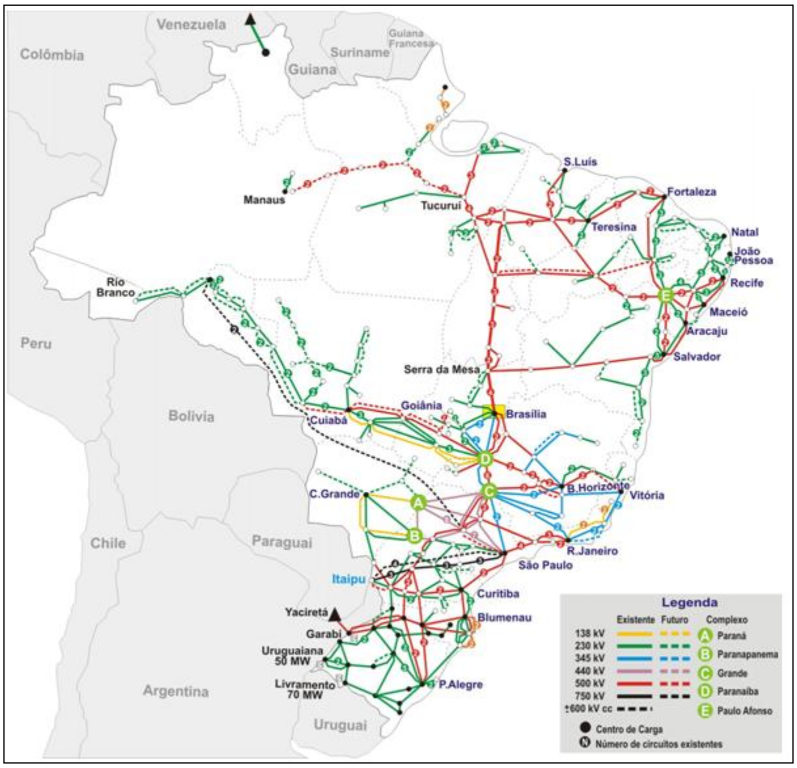


Figure 4: Brazilian National Interconnected System (SIN).

The greenhouse gases and emission sources included or excluded from the project boundary are shown in Table 4.

Table 4: Emission sources included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main source of emissions in the baseline.
		CH_4	No	Minor emission source. This is conservative.
		N_2O	No	Minor emission source. This is conservative.
Project Activity	Emissions from electricity generation	CO_2	No	Wind farms do not have any emissions associated to operation. According to ACM0002 version 12.1.0, no project emissions have to be included for wind power plants.
		CH_4	No	
		N_2O	No	

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

As stated in the approved methodology ACM0002 "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*", version 12.1.0: If the project activity is the installation of a new grid-connected renewable power plant/unit, 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 described in the "Tool to calculate the emission factor for an electricity system" (version 2.2.0).

Therefore, the baseline scenario consists of the electricity that would have been generated and delivered to the grid in the absence of the proposed project activity by:

a) Other plants currently connected to the SIN; and
b) New capacity additions to the SIN.

Hence, the baseline scenario is identified as the continuation of the common practice of power generation, i.e. mainly large hydro power plants with reservoirs and thermal power stations that emit large quantities of carbon dioxide (CO_2) to the atmosphere. Table 5 shows the current composition of the installed power generation capacities by type in Brazil.

Table 5. Installed capacity in the Brazilian power grid SIN by type. (source: ANEEL[3])

Type		Installed capacity [kW]	%
Hydro		82,129,913	66.07
Natural gas	Natural	11,424,053	9.19
	Processed	1,789,183	1.44
Fuel oil	Diesel oil	3,829,618	3.08
	Residual fuel oil	3,132,207	2.52
Biomass	Bagasse	6,907,415	5.56
	Black liquor	1,245,198	1.00
	Wood	385,327	0.31
	Biogas	70,822	0.06
	Rice husk	20,108	0.02
Nuclear		2,007,000	1.62
Coal		1,944,054	1.56
Wind power		1,249,742	1.00
Imports	Paraguay	5,650,000	5.46
	Argentina	2,250,000	2.17
	Venezuela	200,000	0.19
	Uruguay	70,000	0.07

[3] http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp (accessed: 22/11/2011)

Total	124,310,878	100.00

As can be observed, about 66% of the installed capacity consists of hydroelectric power generation capacity. Other important sources are thermal power plants (natural gas, fuel oil, biomass and coal) with an available capacity of about 25% together. On the other hand, wind power is the generation source with the lowest share of installed capacity with only 1.00%, which means that it is still a marginal source for power generation in Brazil.

The project activity therefore has the potential to reduce greenhouse gas emissions by reducing the need of thermal power based on fossil fuels.

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):

Prior consideration of the CDM

The starting date of the project activity, i.e. the moment of when real action began, is the date of the 12th New Energy Auction (12º Leilão de Energia Nova on 17/08/2010[4]) when the project was approved to sign an energy sales agreement with the Chamber of Electrical Energy Commercialization (CCEE[5]). The notifications for prior CDM consideration were sent to the Brazilian DNA and the UNFCCC secretariat within six months from the beginning of the project activity. Therefore the project complies with the requirements on prior consideration established in the "*Guidance on the demonstration and assessment of prior consideration of the CDM*" Version 04.

Additionality

The additionality of the project activity is demonstrated and assessed applying the "*Tool for the demonstration and assessment of additionality*" (version 05.2), as stated in ACM0002 version 12.1.0.

The tool provides a step-wise approach to demonstrate and assess additionality:

- Step 1. Identification of alternatives to the project activity;
- Step 2. Investment analysis to determine that the proposed project activity is either: (1) not the most economically or financially attractive, or (2) not economically or financially feasible;
- Step 3. Barriers analysis; and
- Step 4. Common practice analysis.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

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[4] Summary of energy auction results published by the CCEE, see "*Resultado_12LEN_A3.pdf*"

[5] in Portuguese: Câmara de Comercialização de Energia Eléctrica

According to the Tool for the demonstration and assessment of additionality, project activities applying this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.

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

For the project proponent, the possible alternatives to the proposed project include:

Alternative 1: The proposed project activity undertaken without being registered as a CDM project activity.

Alternative 2: Continuation of the current situation: In this case, the project activity will not be constructed and the power will be solely supplied by the operation of power plants connected to the SIN and by the addition of new power plants.

Sub-step 1b: Enforcement of applicable laws and regulations

The reform of the Brazilian power sector started in 1993 with the enactment of Law 8631, which extinguished the equalization of the tariffs that were in effect and created supply contracts between generators and distributors. Later, it was enhanced by the enactment of Law 9074 of 1995 that created the concepts of Independent Power Producers and of Non-regulated Consumers.

In 1996, a restructuring research project was carried out by the Ministry of Mines and Energy (Ministério de Minas e Energia – MME). The conclusion was that the vertical integration of the electric power companies should be split up into generation, transmission and distribution segments. The aim was to incentive competition within the generation and commercialization segments, and to keep the distribution and transmission under regulation, being considered natural monopolies controlled by the State. Besides, there were other needs identified:

1. Creation of a regulating agency (Electric Power National Agency – Agência Nacional de Energia Elétrica – ANEEL)
1. Creation of an operational entity (National Operator of the Electric System – Operador Nacional do Sistema Elétrico – ONS)
2. Establishment of a framework to accomplish electric power purchase and resale transactions (Wholesale Market for Electric Power – Mercado Atacadista de Energia, or MAE).

After a serious energy supply crisis in 2001, further significant changes were carried out during the years 2003 and 2004, which led to the current electricity market structure and framework. In institutional terms, the new model defined the creation of an institution that would become responsible for the long term planning of the power sector (Energy Research Company – Empresa de Pesquisa Energética – EPE), an institution to evaluate on a continuous basis the security of the supply of electric power (Committee for the Monitoring of the Electric Sector – Comitê de Monitoramento do Setor Elétrico – CMSE), and an institution to provide continuity to the wholesale market, pertaining to the commercialization of electric power within the interconnected system (Chamber for the Commercialization of Electric Power – Câmara de Comercialização de Energia Elétrica – CCEE).

The main rules for electric power generation and commercialization are established by Law 10848/2004, and by Decrees 5163/2004 and 5177/2004[6]:

- **Law 10848/04**: The law divides the wholesale market into two segments with respect to power purchases and sales: free contracts and regulated contracts. In the first segment, all agents except the distributors can freely negotiate (i.e. generators, brokers, importing and exporting agents and free consumers). In the regulated market, the distributors are obliged to acquire the total electricity required to satisfy the demand of the final consumers through energy auctions. The auctions are controlled by the MME and the ANEEL.
- **Decree 5163/04:** Provides rules for the power commercialization and the process for issuing concessions and authorizing power generation.
- **Decree 5177/04:** Provides rules for articles 4 and 5 of law 10848/04 and the organization, tasks and functions of the CCEE.

The business relationships between the agents of the CCEE are predominately regulated by electric power purchase and sales agreements, given by the two frameworks to execute power purchase and sale agreements: the Ambience for Regulated Contracting (Ambiente de Contratación Regulada – ACR) for generation and distribution; and the Ambience for Unregulated Contracting (Ambiente de Contratación Libre – ACL) for generation, commercialization, importing and exporting agents and free consumers. All the bilateral agreements executed between the agents within the context of the SIN must be registered at the CCEE.

Generating Agents of the wholesale market can be[6]:

- *Public Service Generating Concessionaires*: A Federal Public Service Agent, deputized through bidding by the Granting Authority in the competition modality, granted to a legal company or to a consortium of Companies to exploit and to provide public electric power distribution services, pursuant Law 8987, dated February 13, 1995.
- *Electric Power Independent Producers*: Individual Agents or Agents gathered together in consortiums that receive concession, permission or authorization of the Granting Authority to produce electric power to be commercialized on its own account and at its own risk.
- *Self-Producers*: Agents that have obtained the concession, permission or authorization to produce electric power intended for their own exclusive use, allowed to commercialize eventual electric power leftovers, since authorized by ANEEL.

The electric power generating activity has retained its competitive nature, and all generation agents are allowed to sell electric power in both the regulated and unregulated ambience (ACR and ACL). The generators also have open access to the electric power transmission and distribution systems.

Both alternatives, i.e. the proposed project activity undertaken without being registered as a CDM project and the continuation of the current situation, are in compliance with all of the mandatory laws and regulations.

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[6] http://www.ccee.org.br/cceeinterdsm/v/index.jsp?vgnextoid=96d7a5c1de88a010VgnVCM100000aa01a8c0RCRD (accessed: 22/11/2011)

In the following steps, it is shown that the proposed project is not viable without the incentive from the CDM, and therefore is additional.

Step 2: Investment analysis

To conduct the investment analysis, following Sub-steps are used:

Sub-step 2a: Determine appropriate analysis method

According to "Tool for the demonstration and assessment of additionality" (*version 05.2),* three options can be applied for the investment analysis: the simple cost analysis, the investment comparison analysis and the benchmark analysis.

The project activity generates financial and economic benefits other than CER revenues, therefore the simple cost analysis (Option I) is not applicable. Out of the two remaining options, "Guidelines on the assessment of investment analysis" (version 4*)*, states that "*if the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and the benchmark approach is considered appropriate"*. Thus, Option II (investment comparison analysis) is also not applicable and the benchmark analysis (Option III) is chosen to prove additionality.

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

The additionality tool requires an identification of the most appropriate financial indicator. For the case of a power plant that would supply energy to the grid, the most appropriate indicator is the internal rate of return (IRR) as it characterizes the rate of return on invested capital. In this analysis an equity IRR is calculated in accordance with the additionality tool and the corresponding guidelines as indicated above. Taxation is included as an expense in the IRR calculation, i.e. the IRR is determined as a post-tax indicator.

In accordance with the "Guidelines on the assessment of investment analysis" (version 5) a default value for the expected return on equity is used for the benchmark. The relevant benchmark for energy projects in Brazil (Group 1 with Moody's rating Baa3 as given in the guidelines) is 11.75% in real terms. As per the guidelines, since the investment analysis is carried out in nominal terms, the real term values provided can be converted to nominal values by adding the inflation rate. Since no long-term inflation forecasts or target rates of the central bank for the duration of the crediting period exists, the average forecasted inflation rate of 4.57% for the next five years after the start of the project activity published by the IMF (International Monetary Fund World Economic Outlook) is used (based on the forecasts in 2011 for the period from 2012 to 2016).

The benchmark, i.e. the Nominal Return on Equity, is therefore given as 16.32%.

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

For the financial analysis the main cash outflows are given by the investment, the ongoing O&M costs and other expenses, such as fees and taxes. The cash inflows are generated from revenues of electricity sales, which depends on power generation and electricity prices.

Input values for the investment analysis

The electricity sales are made both in the regulated market as well as in the non-regulated market. The sales structure provided in the excel spreadsheet of the financial analysis[7].

The spot price forecasts are obtained from the governmental agency Cepel (Eletrobras)[8] that develops different scenarios of the Brazilian electricity sector, based on projections of demand and offer, and the hydrological conditions, which is a main driver of electricity prices due to the high dependence on hydro power of the SIN. The average annual price forecasts are taken to estimate the income from energy sales in the spot price market (provided in the financial spreadsheets).

The financial structure is applied as suggested by the guidelines for investment analysis (version 5). For the equity/debt structure, the default ratio of 50% equity and 50% debt is used. The typical debt terms can be obtained from the National Bank for Economical and Social Development (BNDES[9]). A summary of the debt terms used for the investment analysis is given in the following table.

Table 6: Terms of debt structure[10].

Parameter	Value	Source
% Debt	50%	Guidelines on investment analysis (version 5).
Term (years)	14	National Bank for Economical and Social Development (BNDES)
Financial Cost	6.00%	Long Term Interest Rate (Taxa de Juros de Longo Prazo - TJLP)
Basic Charge BNDES	0.90%	National Bank for Economical and Social Development (BNDES)
Risk Credit Premium	3.57%	National Bank for Economical and Social Development (BNDES)
Total interest rate (p.a.)	10.47%	Typical rates of the BNDES are composed as: Interest rate = Financial Cost + Basic Charge BNDES + Risk Credit Premium
Monthly interest	0.87%	Annual interest rate divided by 12 months

Table 7 lists the parameters and values used for carrying out the investment analysis.

Table 7. Input values used in the Investment Analysis available at the moment of decision making (all sources and calculations are provided in the Investment Analysis spreadsheets[7]).

GENERAL DESCRIPTION		
Basic Parameters		
Operational life time	20	years
Expected operational starting date	1-Jan-14	date
Exchange rate US$/Euro	1.443	USD/Euro
Exchange rate R$/US$	1.585	BRL/USD
Electricity generation		
Total net energy generation for sales	232,227	MWh / year

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[7] see Excel file "Equity IRR Curva dos VentosWind Farms"

[8] http://www.cepel.br/

[9] Banco Nacional de Desarrollo Económico y Social, www.bndes.gov.br

[10] For details and specific sources, see spreadsheet "DebtStructure" of the Investment Analysis in the Excel file "Equity IRR Curva dos Ventos Wind Farms'

Installed Capacity	56.4	MW
REVENUES		
Electricity sales		
Tariff in the regulated market (real terms, 2014-2033)	62.15	USD/MWh
Tariff in the non-regulated market (real terms, 2014-2018)	86.31	USD/MWh
Tariff in the non-regulated market (real terms, 2014-2033)	variable[7]	USD/MWh
Energy hedge average cost (real terms)	18.93	USD/MWh
Energy hedge amount	25%	%
INVESTMENT		
Total Capital Costs		
Total investment	$167,678,139	USD
% Debt	50.0%	%
% Equity	50.0%	%
OPERATING COSTS & EXPENSES		
Operational costs		
Operation and maintenance	$1,127,409	USD / year
Infrastructure maintenance	$64,051	USD / year
G&A	$762,616	USD / year
Land lease / royalities	$195,712	USD / year
Insurance	$238,413	USD / year
Fees		
TUST	$1,067,522	USD / year
TSFEE	$68,321	USD / year
ONS	$1,423	USD / year
CCEE	$17,766	USD / year
Taxes		
PIS COFINS	3.65%	%
Income tax rate (IRS)	2.00%	%
Social contribution CSLL	1.08%	%
FINANCIAL PARAMETERS		
Inflation		
Inflation rate (forecast)	4.57%	%
Benchmark		
Benchmark Return on Equity (real terms)	11.75%	%
Inflation Adjustment	4.57%	%
Nominal Return on Equity (Ke)	16.32%	%

Result of the investment analysis

Based on the parameters above, the Internal Rate of Return (equity IRR) is calculated as 7.41%, which is substantially below the benchmark rate of 16.32%.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis is carried out by varying the following key parameters to analyze the impact on the equity IRR:

- Energy generation (MWh): in case the average energy generation increases, the quantities sold under the PPAs remain the same and the excess energy would be sold in the spot market.
- Investment costs (USD): the complete investment cost is varied.
- O&M costs (USD/year): the complete O&M cost is varied.
- Energy price in the spot market (USD/MWh): The energy tariffs from sales under the PPAs are not varied, since the prices are fixed though the agreements. Only the spot energy prices are subject to variations in the sensitivity analysis.

The analysis in Table 8 shows that the variations of the key parameters do not result in any significant change of the IRR and that in those scenarios the IRR remains clearly below the benchmark.

Table 8. For the sensitivity analysis each parameter is varied by 10%.

Variation of electricity generation	**+10%**
IRR	**9.36%**

Variation of investment costs	**-10%**
IRR	**8.14%**

Variation of O&M costs	**-10%**
IRR	**7.75%**

Variation of spot price	**+10%**
IRR	**8.42%**

Therefore, it can be concluded that the project activity is not financially attractive.

Step 3: Barrier analysis

The project activity does not apply a barrier analysis.

Step 4. Common practice analysis

For the assessment of common practice analysis, the *"Guidelines on common practice" (version 1)* (Annex 12 of EB 63 report) are applied. The applicable geographical area for the assessment of common practice analysis corresponds to the host country, Brazil.

According to the guidelines for common practice analysis, the following steps are applied[11]:

[11] For the detailed analysis, see Excel file "Common Practice Analysis Curva dos Ventos Wind Farms"

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

For the common practice analysis, the installed capacity of each wind farm is used. The reason is that they are treated as separate wind farms within the regulatory framework. Each of the wind farms has an installed capacity of 28.2 MW, which means that the applicable output capacity for the analysis is between 14.1 MW and 42.3 MW.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number as N_{all}.

According to available information from the National Electric Power Agency – ANEEL, there are 314 operational power plants in the host country with similar capacity, i.e. within the range determined in Step 1; hence $N_{all} = 314$.

Power plants which have been registered as CDM project activities are excluded.

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 as N_{diff}.

As per the guidelines on common practice, different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

(i) Energy source/fuel;
(ii) Feed stock;
(iii) Size of installation (power capacity):
(iv) Investment climate in the date of the investment decision, inter alia:
- Access to technology;
- Subsidies or other financial flows;
- Promotional policies;
- Legal regulations;

(v) Other features, inter alia:
- Unit cost of output (unit costs are considered different if they differ by at least 20%);

For this project there are two major differences that exist to other projects. The first difference is the technology (i.e. energy source/fuel), since most of the other projects identified under step 1 are either thermal power plants or hydroelectric power plants. In Table 9 the power plants identified in step 2 are categorized in accordance with their technology type.

Table 9: Categories and number of power plants with similar capacity as the individual project wind farms.

Thermal power plants (UTE[12])	149
Hydroelectric power plants (PCH and UHE[12])	147
Wind power plants (EOL[12])	18
TOTAL (N_{all})	**314**

The second major difference is the investment climate as per criterion (iv) of the guidelines. Many wind power projects received federal incentives through the Programme of Incentives for Alternative Electricity Sources (PROINFA[13], according to its Portuguese abbreviation) that was introduced by the Ministry of Mines and Energy[14] based on the Law 10438/02 to promote the development of alternative energy sources.

The PROINFA program aims at creating incentives for developing alternative energy sources such as wind energy projects, small hydroelectric plants and biomass projects. Under the program, Eletrobras buys energy generated by these alternative sources for a period of 20 years and transfers it to free consumers and distributor companies, who are then responsible for including the costs of the program in their tariffs for all final consumers in the concession area except for low-income consumers. Tariffs offered for wind power projects under this program are more attractive than for projects participating in the New Energy Auctions, as in the case of the project activity. Moreover, the National Bank for Economical and Social Development (BNDES[15]) approved the opening of a credit line for specific projects included in the PROINFA and financed up to 70% of the construction costs of plants covered by the program[16].

The PROINFA program represents a promotional policy that clearly results in different economical conditions for implementation; thus it is considered a technological difference as per the guidelines.

From the 18 operational wind power projects of similar size in Table 9, 13 projects benefit from the promotional policies under the PROINFA program (see Table 10).

Table 10. Wind power plants in Brazil with an installed capacity within the output range[11].

Type	Plant	Capacity (kW)	PROINFA incentives	Similar Technology[17]
Wind	Parque Eólico de Beberibe	25,600	Yes	No
Wind	Praia do Morgado	28,800	Yes	No
Wind	Volta do Rio	42,000	Yes	No
Wind	Foz do Rio Choró	25,200	Yes	No
Wind	Eólica Paracuru	25,200	Yes	No
Wind	Eólica Praias de Parajuru	28,800	Yes	No

[12] According to the Portuguese abbreviation used by ANEEL

[13] in Portuguese: Programa de Incentivo a Fontes Alternativas de Energia Elétrica

[14] http://www.mme.gov.br/programas/proinfa/menu/programa/Energias_Renovaveis.html (accessed: 08/11/2011)

[15] in Portuguese: Banco Nacional de Desenvolvimento Econômico e Social (BNDES)

[16] http://www.mme.gov.br/programas/proinfa/galerias/arquivos/programa/resolproinfa.pdf (accessed: 08/11/2011)

[17] Here by "technology" we use the definition provided in the *"Guidelines on common practice" (version 1),* i.e. a different investment climate is considered a different technology.

Type	Plant	Capacity (kW)	PROINFA incentives	Similar Technology[17]
Wind	Gargaú	28,050	Yes	No
Wind	Pedra do Sal	18,000	Yes	No
Wind	Parque Eólico Enacel	31,500	Yes	No
Wind	Taíba Albatroz	16,500	Yes	No
Wind	Púlpito	30,000	Yes	No
Wind	Rio do Ouro	30,000	Yes	No
Wind	Bom Jardim	30,000	Yes	No
Wind	Mangue Seco 3	26,000	No	Yes
Wind	Mangue Seco 1	26,000	No	Yes
Wind	Mangue Seco 5	26,000	No	Yes
Wind	Cerro Chato II (Ex. Coxilha Negra VI) *	30,000	No	Yes
Wind	Cerro Chato III (Ex. Coxilha Negra VII) *	30,000	No	Yes

* Project at CDM validation (status: 22/11/2011)

As can be observed, 13 wind power projects are not similar to the project activity. Table 11 summarizes all power plants identified that have a similar output capacity (step 1) but differ by at least one of the criteria for different technologies, i.e. technology type or PROINFA (step 2).

Table 11. Power plants with different technologies than the project activity[11].

Power Plant Characteristics	Identified Power Plants
Thermal power plants	149
Hydroelectric power plants	147
Wind farms under PROINFA	13
TOTAL (N_{diff})	**309**

As can be observed, from the 314 power plants identified under step 1, 309 power plants are substantially different; hence $N_{diff} = 309$.

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.

As per the guidelines, a project is considered a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2.

For the project activity, the factor F is calculated as follows and it can be concluded that the proposed project activity is not a common practice.[18]

$$F = 1 - \frac{N_{diff}}{N_{all}} = 1 - \frac{309}{314} = 0.016 < 0.2$$

__**Conclusion of the additionality analysis**__

[18] See Excel file "Common Practice Analysis Curva dos Ventos Wind Farms"

Since the project activity is not financially attractive (step 2) and the common practice analysis shows that it is not business-as-usual, the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions

The project activity is the installation of a new grid-connected wind power plant interconnected to the SIN. Consequently, the baseline scenario for this project is the electricity generated by the mix of power plants serving the SIN as given by the combined margin established in accordance with the latest version of the "*Tool to calculate the emission factor for an electricity system*" (version 2.2.0).

Baseline emissions are calculated in accordance with ACM0002, as follows:

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

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
$EG_{PJ,\ y}$	=	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/yr)
$EF_{grid,,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the "Tool to calculate the emission factor for an electricity system" (version 2.2.0) (t CO_2/MWh).

Since the project activity is a greenfield renewable energy power plant and no renewable power plant was operated prior to the implementation of the project activity, $EG_{PJ,y}$ is given by the quantity of net electricity generation supplied by the project plant to the grid:

$EG_{PJ,y} = EG_{facility,y}$

Where:

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

Project activity emissions

The methodology ACM0002 states that some project activities may involve project emissions that can be significant, specifically when applying for projects with considerable fossil fuel consumption during operation (geothermal and/or solar thermal projects), when releasing non-condensable gases from the operation (geothermal plants) or when applying for hydro power plants with water reservoirs.

For this project activity, the project emissions are $PE_y = 0$, since it is a wind power plant and none of these criteria applies.

Leakage

The methodology ACM0002 (version 12.1) states:

"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, transport). These emissions sources are neglected."

According to the above, the project activity does not cause any leakage to be included, therefore $LE_y = 0$. Likewise, no credits are claimed for such emissions occurring in the baseline.

Emission reductions

Since project emissions and leakage are 0, the emission reductions by the implementation of the project activity for each year are given by

$$\mathbf{ER_y = BE_y}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2e/yr)

Calculation of the combined margin CO_2 emission factor for grid connected power generation in year y ($EF_{grid,CM,y}$)

Following the methodology ACM0002 version 12.1.0, the combined margin CO_2 emission factor for grid connected power generation in year *y* ($EF_{grid,CM,y}$) is calculated using the latest version of the "*Tool to calculate the emission factor for an electricity system*" (version 2.2.0).

The combined margin emission factor ($EF_{CM,y}$) consists of the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$), as detailed in below.

According to the "*Tool to calculate the emission factor for an electricity system*" version 2.2.0, project participants shall apply the following six steps:

- STEP 1. Identify the relevant electricity systems.
- STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
- STEP 3. Select a method to determine the operating margin (OM).
- STEP 4. Calculate the operating margin emission factor according to the selected method.
- STEP 5. Calculate the build margin emission factor.
- STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electricity systems

For determining the electricity emission factors, a **project electricity system** is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

Further the tool states:

"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."

In Resolution No. 8 published on 26th of May 2008[19], the Brazilian DNA defines the SIN (*Sistema Interligado Nacional*) as the relevant electricity system for any project activity using the methodology ACM0002. Moreover, the DNA publishes the operating and build margin emission factors based on data available for the entire SIN, in accordance with that resolution.

Step 2: Choose whether to include off-grid power plants in the project electricity system

It may be chosen between the following two options to calculate the operating margin and build margin emission factor:

- **Option I:** Only grid power plants are included in the calculation.
- **Option II:** Both grid power plants and off-grid power plants are included in the calculation.

The DNA applies the method *Dispatch data analysis OM,* which requires dispatch data of the connected the power plants. Therefore Option I is applied and only grid power plants are included in the calculation.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) as applied by the Brazilian DNA is based on option (c) Dispatch data analysis OM, of the tool:

$$EF_{grid,OM} = EF_{grid,OM\text{-}DD,y}$$

Where:

$EF_{grid,OM}$	=	Operating margin CO_2 emission factor in year y (t CO_2/MWh)
$EF_{grid,OM\text{-}DD,y}$	=	CO_2 emission factor for grid power units in the top of the dispatch order in hour h in year y (t CO_2/MWh)

The Brazilian DNA provides the hourly emission factor available on the website: http://www.mct.gov.br/

This approach is not applicable to historical data and, thus, requires annual monitoring of the emission, i.e. the operating margin emission factor $EF_{grid,OM,}$ will be calculated *ex post*, determined for the year in

[19] Available at http://www.cetesb.sp.gov.br

which the project activity displaces grid electricity. It will be updated annually during the crediting period as per the emission factors provided by the Brazilian DNA for each year.

Step 4: Calculate the operating margin emission factor according to the selected method

The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour *h* where the project is displacing grid electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

The emission factor is calculated as follows:

$$EF_{grid,OM,y} = EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \times EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where:

$EG_{PJ,h}$	=	Electricity displaced by the project activity in hour *h* of year *y* (MWh)
$EF_{EL,DD,h}$	=	CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh)
$EG_{PJ,y}$	=	Total electricity displaced by the project activity in year *y* (MWh)
h	=	Hours in year *y* in which the project activity is displacing grid electricity
y	=	Year in which the project activity is displacing grid electricity

As mentioned above, annual monitoring is required and the updated data from the Brazilian DNA will be used for the corresponding monitoring periods. The DNA provides directly the values for $EF_{grid,OM-DD,h}$, so the operating margin emission factor $EF_{grid,OM-DD,y}$ can be calculated with the equation above by applying the hourly and total power generation of the project activity.

Step 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, the project participant has chosen option 1 of the "*Tool to calculate the emission factor for an electricity system"* (version 2.2.0):

Option 1**:** *For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.*

The sample group of power units *m* used to calculate the build margin is determined as per the procedure presented in the "*Tool to calculate the emission factor for an electricity system"* (version 2.2.0), consistent with the data vintage selected above, as follows:

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 ($AEG_{SET\text{-5-units}}$, in 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);

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).

Otherwise:

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);
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).

Otherwise:

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 ($SET_{sample\text{-}CDM\text{-}>10yrs}$).

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

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

The build margin emission factor is also provided by the Brazilian DNA, published on the website: http://www.mct.gov.br/

Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

According to the *"Tool to calculate the emission factor for an electricity system"*, version 2.2.0, the weighted average CM method (option A) should be used as the preferred option. Thus, option A is chosen.

Weighted average CM

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

According to the tool, wind power generation project activities should apply the following values of w_{OM} and w_{BM} for the first crediting period and for subsequent crediting periods: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature).

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

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor in year *y*
Source of data used:	Brazilian DNA (Ministry of Science and Technology), published on the website http://www.mct.gov.br/

Value applied:	0.1404
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Brazilian DNA provides the emission factors. The most recent value available at the time of project submission to validation is from 2010.
Any comment:	The data vintage for this parameter is chosen to be *ex ante*.

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

An *ex ante* calculation of estimated baseline emissions follows.

As explained in section B.6.1. the project is a greenfield renewable energy power plant and the 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* is given by the quantity of net electricity generation supplied by the project plant to the grid, which is estimated as:

$EG_{PJ,\,y} = EG_{facility,y} = 232{,}227$ MWh/yr

The combined margin emission factor is estimated by using an estimate of the operating margin emission factor (dispatch data that will be monitored as per the *ex post* data vintage) and the build margin emission factor (*ex ante* data vintage):

<u>Operating margin (OM):</u>

The operating margin emission factor is given as

$$EF_{grid,OM,y} = EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \times EF_{EL,DD,h}}{EG_{PJ,y}}$$

Since the dispatch data analysis method requires real hourly data of the grid and the project generation, the value cannot be determined exactly before project operation. For the previous *ex ante* estimation, the historical annual average of the dispatch data is used as an approximation, assuming a constant generation behavior without hourly variation; thus the calculation is simplified and generation-weighting can be neglected:

$$EF_{grid,OM,y} = \frac{\sum_h EF_{EL,DD,h}}{\sum_h} = \text{average}\left(EF_{EL,DD,h}\right) = 0.4821\ tCO_2/MWh$$

<u>Build margin (BM):</u>

The build margin is determined *ex ante* and is fixed for the crediting period:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} = 0.1404\ tCO2/MWh$$

Combined margin (CM):

By weighing the OM and BM emission factors, the CM emission factor gets

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} = 0.3967 \text{ tCO2/MWh}$$

Emission reductions (ER_y):

By calculating the baseline emissions, emission reductions are estimated *ex ante* as:

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

ER_y = 232,227 MWh/yr × 0.3967 tCO_2/MWh

ER_y = 92,125 tCO_2/MWh

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

Period	Baseline Emissions (tCO_2e)	Project Activity Emissions (tCO_2e)	Leakage (tCO_2e)	Emission Reductions (tCO_2e)
2014	92,125	0	0	92,125
2015	92,125	0	0	92,125
2016	92,125	0	0	92,125
2017	92,125	0	0	92,125
2018	92,125	0	0	92,125
2019	92,125	0	0	92,125
2020	92,125	0	0	92,125
Total emission reductions (7 crediting years)	**644,873**	**0**	**0**	**644,873**
Annual average over the crediting period of estimated reductions	**92,125**	**0**	**0**	**92,125**

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/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the

	grid in year *y*
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	232,227 MWh/yr
Description of measurement methods and procedures to be applied:	The project proponent will install and control the main electricity meter and a backup meter (both with an accuracy class of 0.2%) at the substation, which is defined as the "delivery point" to the grid. The measurement at this point is made after transmission losses and works bi-directionally, i.e. the net energy delivered to the grid is measured. The backup meter assures continuous measurement in case the main meter fails. In cases both meters would fail, the energy generated would be estimated based on other measurement points in the grid and could be obtained from the CCEE. The measurement frequency is established by the ONS sub-module 12.4 "Collection of measured data for billing"[20], which requires measurements every five (full) minutes. The data will be recorded for CDM monitoring at least on a monthly basis and kept during a minimum of two years after termination of the last crediting period.
QA/QC procedures to be applied:	Measurements are cross-checked with invoices from energy sales or the database of the CCEE to verify the consistency of the data. The calibration frequency of the meters is two years (maximum) as established by the ONS sub-module 12.3 "Maintenance of measurement system for billing"[21]. Calibration shall be performed by field or laboratory tests based on the technical regulations specified in the INMETRO No. 431 of December 4, 2007 [22].
Any comment:	This corresponds to the parameter $EG_{PJ,y}$ as used for the calculation of the operating emission factor.

Data / Parameter:	$EG_{PJ,h}$
Data unit:	MWh
Description:	Electricity displaced by the project activity in hour *h* of year *y*
Source of data to be used:	Project activity site
Value of data applied for the purpose of calculating expected	No estimation is available on an hourly basis. For *ex ante* estimation, the expected total yearly generation is applied to the average emission factor (see section B.6.3).

[20] in Portuguese: *Coleta de dados de medição para faturamento,* available at http://www.ons.org.br/download/procedimentos/modulos/Modulo_12/Submodulo%2012.4_Rev_1.1.pdf (accessed: 08/11/2011)

[21] in Portuguese: *Manutenção do sistema de medição para faturamento,* available at http://www.ons.org.br/download/procedimentos/modulos/Modulo_12/Submodulo%2012.3_Rev_1.0.pdf (accessed: 08/11/2011)

[22] National Institute of Metrology, Standardization and Industrial Quality

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The project proponent will install and control the main electricity meter and a backup meter (both with an accuracy class of 0.2%) at the substation, which is defined as the "delivery point" to the grid. The measurement at this point is made after transmission losses and works bi-directionally, i.e. the net energy delivered to the grid is measured. The backup meter assures continuous measurement in case the main meter fails. In cases both meters would fail, the energy generated would be estimated based on other measurement points in the grid and could be obtained from the CCEE. The measurement frequency is established by the ONS sub-module 12.4 "Collection of measured data for billing"[20], which requires measurements every five (full) minutes. The data will be recorded for CDM monitoring at least on a monthly basis and kept during a minimum of two years after termination of the last crediting period
QA/QC procedures to be applied:	Measurements are cross-checked with invoices from energy sales or the database of the CCEE to verify the consistency of the data. The calibration frequency of the meters is two years (maximum) as established by the ONS sub-module 12.3 "Maintenance of measurement system for billing"[21]. Calibration shall be performed by field or laboratory tests based on the technical regulations specified in the INMETRO No. 431 of December 4, 2007 [22].
Any comment:	These data are used for the calculation of the emission factor.

Data / Parameter:	$EF_{EL,DD,h}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y*
Source of data to be used:	Brazilian DNA (Ministry of Science and Technology), published on the website http://www.mct.gov.br/
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.4821 tCO_2/MWh For *ex ante* estimation, the average of the hourly emission factors of the most recent year available is used (year 2010), see explanations in section B.6.3.
Description of measurement methods and procedures to be applied:	The relevant values are updated and published by the Brazilian DNA (Ministry of Science and Technology) and will be used for the corresponding monitoring periods. The data is available at the website http://www.mct.gov.br/
QA/QC procedures to be applied:	No specific QA/QC procedures are required since the values are calculated by the DNA and made publicly available.
Any comment:	-

B.7.2. Description of the monitoring plan:

The project activity will apply ACM0002 / Version 12.1 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

The justification for the choice of the monitoring methodology is the same as for the choice of baseline methodology, which is presented in Section B.1.1.

Data gathering and recording

According to methodology ACM0002 (version 12.1.0), the main parameters that need to be monitored during the operation of the wind farm are:

- $EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*;
- $EG_{PJ,h}$ = Electricity displaced by the project activity in hour *h* of year *y;* and
- $EF_{EL,DD,h}$ = CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y*.

The energy generated by the project will be measured according to the standard procedures established by the Brazilian energy sector. The ONS and the CCEE provide the framework with the specifications and technical requirements for energy measurements and billing.

The project proponent will install and control the main electricity meter and a backup meter (both with an accuracy class of 0.2%) at the substation, which is also defined as the "delivery point" to the grid. The measurement at this point is made after transmission losses and works bi-directionally, i.e. the net energy delivered to the grid is measured. The backup meter assures continuous measurement in case the main meter fails. In cases both meters would fail, the energy generated would be estimated based on other measurement points in the grid and could be obtained from the CCEE.

The frequency of electricity generation measurement is established by the ONS sub-module 12.4 "Collection of measured data for billing"[20], which requires measurements every five (full) minutes. The data will be recorded for CDM monitoring at least on a monthly basis and kept during a minimum of two years after termination of the last crediting period. Measured data can be cross-checked with invoices from energy sales or the database of the CCEE to verify the consistency of the data. The calibration frequency of the meters is two years (maximum) as established by the ONS sub-module 12.3 "Maintenance of measurement system for billing"[21]. Calibration shall be performed by field or laboratory tests based on the technical regulations specified in the INMETRO No. 431 of December 4, 2007[22].

The grid emission factor will be calculated as explained in section B.6.1. The operating margin emission factor will be determined with the dispatch data analysis method for each monitoring period by using the corresponding hourly emission factors from the Brazilian DNA (http://www.mct.gov.br/). The build margin emission factor uses the *ex ante* data vintage and therefore does not require specific monitoring.

All required data will be collected by the project proponents and stored electronically. The measurements are carried out by a technician either directly in the plant or from the central office, since data can be captured remotely by SCADA. The measurements are made by each individual subsidiary of the project. The rest of the data is collected by EGP Brasil, supported by the CDM Coordinator for Latin America.

The monitoring reports will be developed according to the most recent rules, by using the applicable form of the UNFCCC.

Figure 5 shows a diagram of the net energy measurement and data collection.

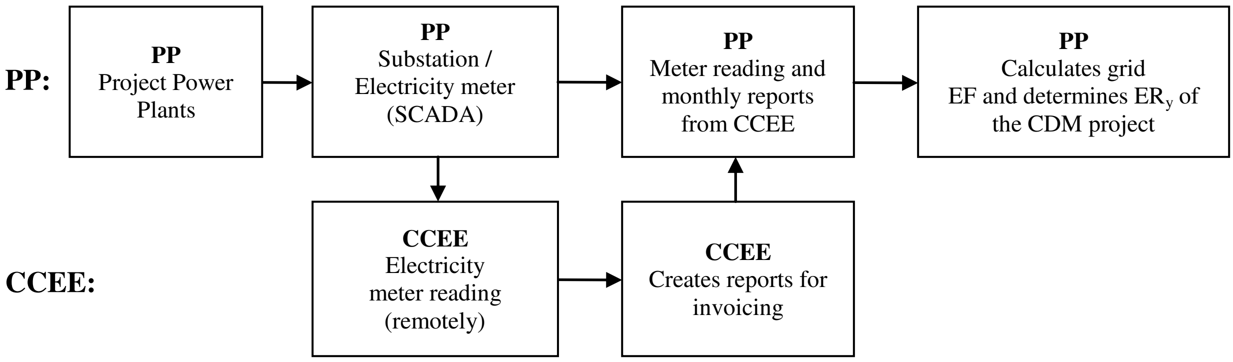

Figure 5. Monitoring process of the proposed project activity.

Real emission reductions of each monitoring period will be determined applying the following formulae:

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

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 completion of baseline study: 22/11/2011

Name of person/entity determining the baseline:

Christian Ehrat - MGM Innova
Email: cehrat@mgminnova.com

Sandra Maria Apolinario dos Santos - MGM Innova
E-mail: sapolinario@mgminnova.com

(MGM Innova is not a project participant)

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

17/08/2011

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

20 years

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

C.2.1. Renewable crediting period:

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

01/01/2014

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.0. Starting date:

NA

C.2.2.2. Length:

NA

SECTION D. Environmental impacts

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

The Federal Law 6.938/1981 sets forth the National Environmental Policy and expressly establishes the Environmental Permitting procedure and Environmental civil liability.

With the ratification of the Constitution of the Federative Republic in 1988, Brazil adopted the environmental protection as a constitutional right. According to its article 225, all individuals have the right to enjoy an ecologically balanced environment, while both the government and society are responsible for the achievement of such purpose. The environmental protection is based on certain instruments such as the environmental permitting procedure, the Environmental Impact Assessment, the creation of protected areas, and environmental liability.

As set by Federal Law 6.831/1981, the Brazilian Institute for Environment and Renewable Resources (IBAMA) is in charge of applying environmental statutes and regulations on the federal level. Most importantly, among IBAMA's attributions are the procedures of environmental permitting of activities. Besides, CONAMA (National Environmental Council) also acts on a federal level and is granted power to pass regulations applicable to environmental matters, working as a body of technical specialists.

Environmental licensing is a legal requirement prior to installation of any project or activity potentially polluting or degrading the environment and has as one of his most expressive features social participation in decision making, by holding public hearings as part of the process.

This obligation is shared by State Agencies for Environment and IBAMA, as integral parts of SISNAMA (National System for the Environment). The SISNAMA aims to establish a network of government agencies at all levels of the Federation that could ensure the mechanisms to effectively implement the PNMA.

IBAMA operates mainly in the licensing of large infrastructure projects involving impacts on more than one state and offshore oil and gas activities. Apart from these cases, the environmental licensing is done by government agencies. As established by the Constitution of 1988 in article 225 the government has the duty to demand an environmental assessment prior to the installation of works and activities that may potentially cause significant degradation of the environment.

Pursuant to CONAMA Resolution 237/97, there are three kinds of environmental permits:

- Previous Permit (LP, *Licença Prévia*) – granted at the preliminary stage of the enterprise or activity, approving its location and conception, certifying its environmental feasibility and establishing basic requirements and conditions to be met at the next stages of its implementation. At this stage, an Environmental Impact Assessment and its corresponding report may be required, if the activity has a greater potential for pollution;

- Installation Permit (LI, *Licença de Instalação*) – authorises the installation of the enterprise or activity in accordance with the specifications contained in the approved plans, programs and projects, including environmental control measures and other conditions; and

- Operation Permit (LO, *Licença de Operação*) – authorises the operation of the activity or enterprise subsequently to the verification of effective compliance with the requirements set forth in the previously mentioned permits.

As mentioned before, depending on the project type, the responsibilities of licensing are transferred to the state level, as it is the case for this project activity. An EIA for the project was developed by the company Nordeste Ambiental Ltda in accordance with all the legal requirements and completed in July 2009. The Institute of the Environment and Hydrological Resources INEMA (*Instituto do Meio Ambiente e Recursos Hídricos*) approved the EIA and issued the preliminary license. The other licenses are expected to be issued as per the Table 12.

Table 12: Overview and expectations of the licensing process.

Licence	Date of issuance (real / expected)	Responsible public entity
Preliminary License (Licença Prévia)	31/05/2011 (real)[23]	INEMA / BA
Installation License (Licença de Instalação)	April 2012 (expected)	INEMA / BA
Operational License (Licença de Operação)	December 2013 (expected)	INEMA / BA

There are no transboundary effects due to the project activity.

[23] See "LP_Curva dos Ventos.pdf"

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:

In Brazil, the environmental rules and licensing process policies are very strict and in line with the best international practices. There are no significant environmental impacts identified in the EIA.

SECTION E. Stakeholders' comments

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

The "Manual for Submitting CDM Project Activities" of the Interministerial Commission on Global Climate Change that is coordinated by the Ministry of Science and Technology outlines the detailed process for obtaining the Letter of Approval for a CDM project. The applicable principles are based on a series of fundamental CDM requirements established through the Marrakesh Accords, on which the DNA must

(i) attest to the voluntary participation of project activity participants in the CDM;
(ii) attest that the project activity contributes towards sustainable development; and
(iii) issue a letter of approval of the project for national participants in CDM project activities.

As a key part of the LoA issuance, the rules for the stakeholder consultation process as provided in the aforementioned manual need to be followed.

Basically, the stakeholders must be informed by a written invitation about the development of the project activity and the opportunity to submit their comments. The project proponent shall make publicly available a PDD version in Portuguese and a declaration about the contribution to the sustainable development of five key aspects[24], including: local environmental sustainability, development of working conditions and net generation of jobs, income distribution, training and technological development, and regional integration and articulation with other sectors. The invitation needs to be sent and the documents made public at least 15 days prior to the start of the global stakeholder process, which defines the beginning of the validation process.

As per the manual and since the project is located in only one state, the letters of invitation are sent to the following stakeholders:

- City hall of each involved township;
- City council of each involved township;
- State environmental body;
- Municipal environmental bodies;
- Brazilian NGO Forum and Social Movements for the Environment and Development – FBOMS;
- Community associations whose purposes are direct or indirectly related to the project activity;
- The State Attorney General of the state involved, or, depending on the case, the Attorney General for the Federal District and Territories;

[24] Annex III of Resolution no. 1

- Federal Attorney General.

These procedures guarantee that the stakeholders are aware of the CDM project and can submit their comments, and that those can be taken into account by the project participant, the DOE for the validation process and the DNA for the LoA issuance.

The project proponent is following all procedures to guarantee a correct and transparent stakeholder consultation process.

E.2. Summary of the comments received:

No comments are received so far. Any comments that will be submitted during the consultation period will be taken into account.

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

No comments are received so far. Any comments that will be submitted during the consultation period will be taken into account.

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project.

Annex 3

BASELINE INFORMATION

All baseline information included in section B.

Annex 4

MONITORING INFORMATION

All monitoring information is included in subsection B.7.