



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

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**SECTION A. General description of project activity****A.1. Title of the project activity:**

Peralta I Wind Power Project

History of the document: Version 05, dated. 30/11/2012

A.2. Description of the project activity:

The proposed project activity involves the development (construction and O&M) of an onshore wind farm located at 280 km north from Montevideo, near the village of Peralta, Department of Tacuarembó (Uruguay). This wind farm will consist of 25 wind turbines with 2MW each, resulting in total installed capacity of 50 MW. The purpose of the project activity is to generate renewable electricity to the national grid of Uruguay. The energy will be dispatched to a first electrical substation located in the wind farm and then dispatched to an electrical substation called “Cuchilla Peralta” (owned by UTE and where the energy produced will be measured) located 50 m from the first substation. From there the energy will be transported through a 30 km electric line with 150 kV to the “Rincón de Bonete B” and then to the “Rincón de Bonete” station where the electricity will be finally dispatched to the grid.

The project will positively contribute to the sustainable development of the host country in several ways,

- Reducing greenhouse gas emissions by replacing fossil fuel based power generation.
- By contributing to the reduction of pollutants such as sulphur dioxide, nitrogen oxides and particles resulting from the use of fossil fuels for electricity generation.
- By contributing to Uruguay's energy independence from Argentina and Brazil, by taking advantage of its renewable wind resource.
- By creation of a new source of employment.
- By helping to diversify the power mix of the national grid system: in March 2011, 72.71% of annual total generation came from hydropower plants, 26.65% from thermal power plants and the rest, 0.64% from wind power (see Figure 1: Distribution of Electric Generation)
- By developing experience in wind power and therefore reducing barriers related to this technology.
- By employing a non-conventional technology, the project activity will contribute to technology transfer.
- In addition the project will create local “know-how” related to the installation and operation of wind turbines.

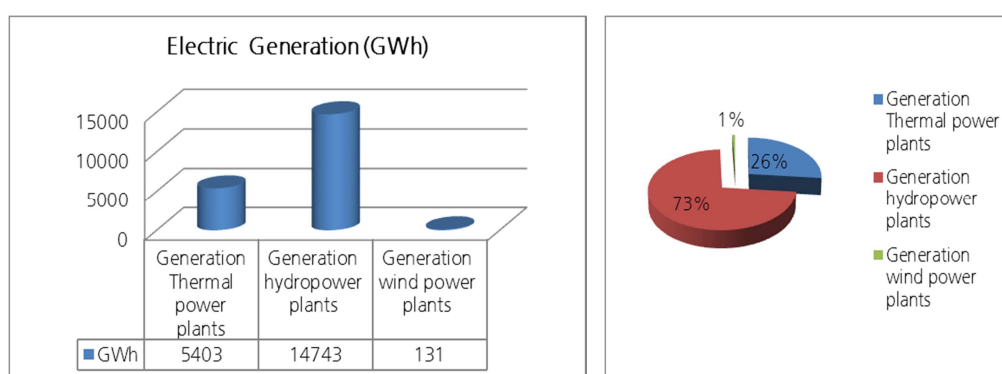


Figure 1: Distribution of Electricity Generation, March 2011. Source, [Dirección Nacional de Energía \(MIEMDNE\)](#).

**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)
Uruguay (host)	Palmatir S.A.	No

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:**

South America

A.4.1.1. Host Party(ies):

Uruguay

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

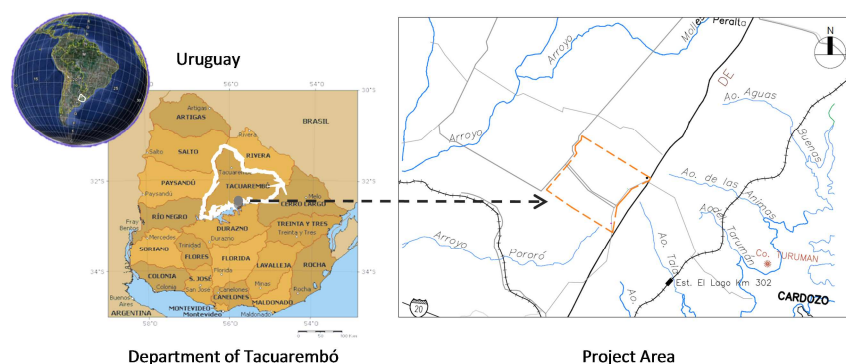
Department of Tacuarembó

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

Village of Peralta

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

The wind farm will be located in the Peralta community, Region of Tacuarembó, Uruguay. The project activity is located 280 km north from Montevideo, going along the national road n°. 5. The nearest population centre is the “Caserío Cuchilla de Peralta” located approximately 12 km northeast of the area of entrepreneurship.

**Figure 2: Location of project activity**



The center coordinates of the project are the following:

Geographic coordinates	Decimal degrees	Longitude.: 56.432097 W	Latitude.: 32.570942 S
	Sexagesimal degrees	Long.: 56°26'55.55"W	Lat.: 32°34'15.39"S
UTM Coordinates	X (East): 553306.78	Y (North): 6396134.61	Zone: 21

The wind farm is located in the patterns No. 8,508, 11,088, 11,089, 12,501, 12,502 and 12,503, corresponding to the 10th Judicial Division of the Department of Tacuarembó.

The coordinates in decimal degrees and the location each turbine are the following:

Table 1: Turbine coordinates in decimal degrees of the Peralta I Wind Power Project

Wind turbine reference	Decimal coordinates	
	latitude S	longitude W
1	32.57224516	56.4251441
2	32.57531186	56.42311105
3	32.57751306	56.42709207
4	32.56456084	56.43737914
5	32.56733033	56.4354018
6	32.57078844	56.43411244
7	32.57541122	56.43305003
8	32.57960646	56.43120182
9	32.58560836	56.43792959
10	32.58861001	56.43945583
11	32.59329735	56.44072663
12	32.59640163	56.44099505
13	32.60036957	56.44074663
14	32.58190941	56.44798891
15	32.58870331	56.45036595
16	32.5932179	56.45341784
17	32.56224453	56.45005865
18	32.56815572	56.45067239
19	32.57375923	56.45313108
20	32.57876039	56.45607314
21	32.55897022	56.46050642
22	32.5646878	56.46226176
23	32.5690062	56.46591117
24	32.57482583	56.47048958
25	32.58030896	56.47445261

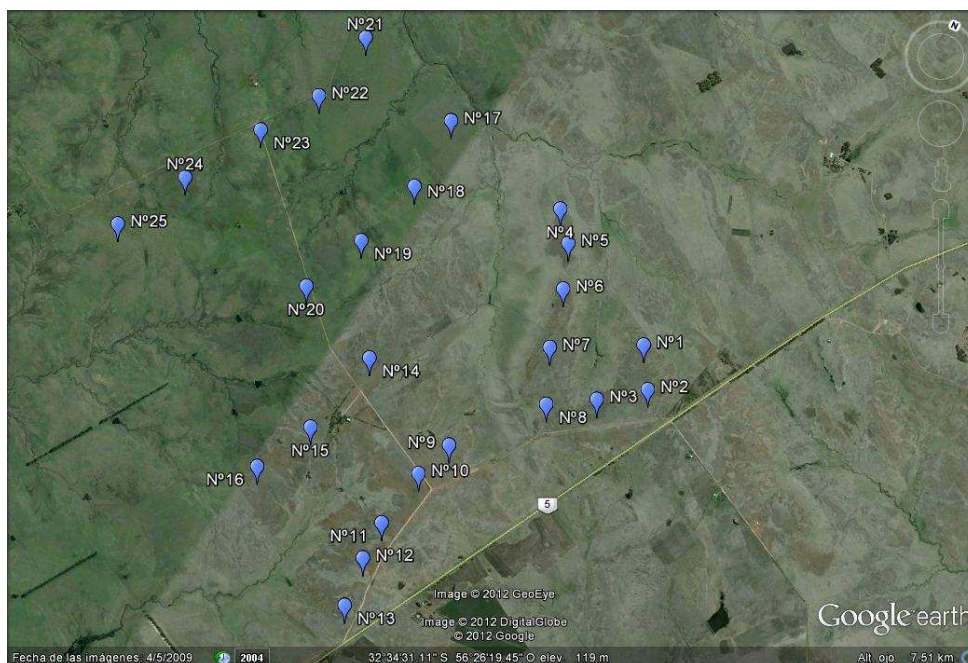


Figure 3: Specific location of the turbines

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

The project falls in Sectoral Scope I: Energy Industries (Renewable/non-renewable).

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

The purpose of the project is the installation of 25 wind turbines of 2MW with a total installed capacity of 50MW wind farm called Peralta Park, located in the town of Peralta in the department of Tacuarembó, Uruguay. The project owner, Palmatir S.A., awarded the Bid No. K39607 carried out by the national energy company UTE Uruguay (National Electric Power Generation and Transmission). Palmatir S.A. signed a power purchase agreement with UTE (PPA) under the provisions of the tender, with a deadline for the construction of 3 years plus an extension of 6 months from the enactment of the contract. The

specifications refer that bidders should take into account the concept of additionality, these implies that the income from the CDM are determinants for achieving economic viability.

The period of exploitation is 20 years from the final acceptance and implementation of the project.

GEAR BOX	
Type	1 planetary stage 2 parallel stages
Ratio	1:100.5 (50 Hz) 1:120.5 (60 Hz)
GENERATOR 2.0 MW	
Type	Doubly-fed machine
Rated power	2.0 MW
Voltage	690 V AC
Frequency	50 Hz / 60 Hz
Protection class	IP 54
Power factor	0.95 CAP - 0.95 IND throughout the power range*
ROTOR	
Diameter	90 m
Swept area	6,362 m ²
Rotational speed	9.0 - 19.0 rpm
BLADES	
Number of blades	3
Length	44 m
Airfoils	DU + FFA-W3
Material	Pre-impregnated epoxy glass fiber + carbon fiber
TOWER	
Type	Modular
Height	67, 78 y 100 m

Table 2: Design Parameters Gamesa G90 - 2.0 MW 50 Hz

The project includes the installation of 25 wind turbines selected through competitive bidding, and a complementary set of units aimed at various services. Each turbine has a unitary capacity of 2 MW, totalling 50 MW. The energy generated will be turned over to the national grid through a electric line and a substation substation (high voltage 150 kV), located in Rincón del Bonete.

The project will be made by the company Palmatir S.A., according to the General Regulations of the Regulatory Framework Electricity System.

The **turbine** to be used for the wind farm is the model of Gamesa, G90 - 2 MW 50 Hz. It consists mainly of a rotor, a generator and a transformer located at the top of a tower tubular truncated cone 100 m high, founded on a concrete pad. The total weight of the turbine is about 367 ton, with the weight of 260 ton tower, the nacelle 70 ton and 37 ton rotor. Each rotor has 3 blades made of organic matrix composite reinforced with fiberglass or carbon, 44 m long, sweeping a total area of 6,362 m², with a variable speed of 9 to 19 rpm, the rotor diameter is 90 m. Generator rated power is 2,000 kW and the voltage is 690 V.

Data on wind turbine design parameters are presented in the following table:

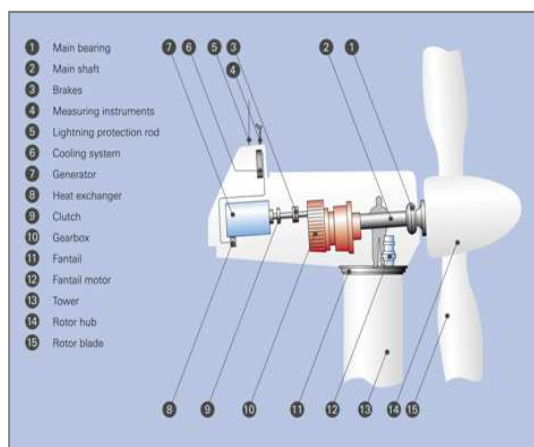


Figure 4: turbine components

The main components of the turbines, described in a brief are:

- 2. Main shaft: It transmits the torque produced by the wind on the rotor to the gearbox.
- 4. Wind sensor: ultrasonic type.
- 7. Electric Generator: asynchronous doubly-fed four-pole, wound rotor and slip rings.
- 10. Gearbox: transmits power to the generator main shaft. It consists of three stages combined, a planetary and two parallel shafts.
- 13. Tower: holding the gondola to 100 m high.
- 14/15. Rotor: It has a diameter of 90 m and consists of three blades and a hub. The blades collect the wind power and its power transmitted to the hub.

It is important to note that there is a transfer of technology developed in Europe by a global technological leader in the design, manufacture, installation and maintenance of wind turbines, with more than 15



years' experience and with around 22,000 MW installed in 30 countries on four continents and 14,000 MW under maintenance.

Project owners are employing an environmentally safe and sound technology.

- Noise control: Aerodynamic blade tip and mechanical component design minimize noise emissions. In addition, Gamesa has developed the Gamesa NRS® noise control system, which permits programming the noise emissions according to criteria such as date, time or wind direction. This achieves the goals of local regulation compliance as well as maximum production.
- For the fifth year in a row, Gamesa is listed on the Dow Jones Sustainability World Index (DJSI World), which tracks the economic, environmental and social performance of leading sustainability-driven companies worldwide. Following economic, social and environmental criteria, the index assess company's Corporate Responsibility performance. In this year's ranking, Gamesa achieved its highest ever overall score while it once again obtained the best rating for the industry on the social dimension and recorded notable improvements in its environmental dimension scores, driven by the trends in the metrics tracking its consumption of energy and other natural resources.

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

>>A 7-year renewable crediting period (renewable two times) is selected for the proposed project activity. The project will displace electricity from a more carbon-intensive grid with an emission factor of 0.519 tCO₂/MWh. The project is expected to displace from the Uruguayan national grid 176,700MWh of electricity per year.

Years	Annual estimation of emission reductions in tonnes of CO _{2e}
November 2013	15,284
2014	91,705
2015	91,705
2016	91,705
2017	91,705
2018	91,705
2019	91,705
October 2020	76,421
Total estimated reductions (tonnes of CO_{2e})	641,936
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_{2e})	91,705

Table 3: Indicates expected emission reductions over the first crediting period

**A.4.5. Public funding of the project activity:**

No public funds from Annex I countries are involved in the Project.

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 approved consolidated baseline and monitoring methodology utilized for the project activity is the ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” Version 13.0.0, EB67,¹.

The followings tools are also applied:

- “Tool to calculate the emission factor for an electricity system” (Version 02.2.1) EB 63 Report Annex 19².
- “Tool for the demonstration and assessment of additionality”, (Version 06.1.0), EB 69 Report Annex 20,³.

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 13.0.0.0) is applicable to this project activity as it is explained on the next table:

	Applicability conditions Project case	Applicability conditions Project case
0	This methodology 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);	
1	The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The proposed project activity is a new grid-connected wind power generation project activity that will install 25 wind turbines of 2 MW each with a total installed capacity of

¹ ACM0002 – Available in: <http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT>

² Available in: <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-07-v2.2.1.pdf>

³ Available in: <http://cdm.unfccc.int/methodologies/PAMethodologies/tools/am-tool-01-v6.1.0.pdf>



	Applicability conditions Project case	Applicability conditions Project case
		approximately 50 MW.
2	In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2 to calculate the parameter EGPJ,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 addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	This project activity does not involve capacity addition, retrofit or replacement. Thus, this is not applicable.
3	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/m²; 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/m².	This project activity does not involve hydro power plant. It is a new wind power plant. Thus, this is not applicable.
4	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 is a new wind power project. It does not involve switching from fossil fuel to renewable energy sources at the site of the project activity. Thus not involve biomass firing for energy generation and is not a hydropower plant. Thus this is not applicable.

Table 4: Justification of the choice of the methodology and why it is applicable to the project activity

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

>>As per by ACM0002 (version 13.0.0), the greenhouse gases and emissions sources included in or excluded from the project boundary are summarized in the following table:

	Source	Gas	Included?	Justification/Explanation
Baseline	CO ₂ emissions from electricity generation in fossil fuel power plants that are displaced due to the project activity	CO ₂	Yes	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
Project activity	Proposed project activity	CO ₂	No	As per by ACM0002, the project emissions for most renewable power generation activities correspond to zero.

Table 5: Emission sources.

The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to, in accordance with the approved consolidated baseline methodology ACM0002 (version 13.0.0).

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

The baseline scenario has been identified as per the applicable methodology. According to description of ACM0002 (version 13.0.0), 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 emissions factor for an electricity system”.

The proposed project activity consists on the installation and operation of a new grid connected wind power project. Thus, according to this, the baseline scenario for the proposed project activity is the Uruguayan national grid, which is in accordance with the provisions in the applicable methodology.

**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):**

According to the approved methodology ACM0002 (version 13.0.0), the latest approved version of the “Tool for the demonstration and assessment of additionality (Version 06.1.0) shall be utilized to demonstrate and assess the additionality.

Demonstration of the Prior CDM Consideration

According to the Guidelines on the demonstration and assessment of prior consideration of the CDM, version 03 (EB49, Annex 22), for project activities with a starting date on or after 02 August 2008, the project participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status.

In the following table, the milestones related with the prior consideration of the CDM are summarized⁴:

Milestones	Date
The Decree 403/009, which instructed UTE competitive performance of procedures for the procurement of 300 MW of wind energy, and regulates the first stage, a total of 150 MW, was approved ⁴ .	24/08/2009
Published in the UTE website the text of the specifications call for buying 150 MW wind energy (K39607), within the framework of 403/009 and 041/010 decrees. The specifications refer that bidders should take into account the concept of additionality, these implies that the income from the CDM are determinants for achieving economic viability ⁴	18/02/2010
End of the period for submission of bids ⁴ .	Opening performed with date: 13/07/10
Submission of Prior Consideration to DNA	06/09/2010 ⁵
Submission of Prior Consideration to UNFCCC ⁶	09/09/2010

⁴ [Information regarding the milestones of the competitive bidding of 150 MW - 2010](#)

⁵ The evidence was submitted to the DOE

⁶ [Prior Consideration](#) UNFCCC



Milestones	Date
UTE sent to bidders the Projects of network connection, and they have a period to recalculate their prices offered by the energy, taking into account the costs associated with the connection works.	made to date 22/11/2010
"Assessment of energy production in the Peralta I Wind Power Project considering the implementation of Gamesa G 90 2.0 aero generators", GL Garay Hassan.	21/12/2010
Presentation of complement of offerings. Bidders submit their final price offered by the energy and the domestic share of component of investment, as well as documentation on the projects. From this moment, UTE has all the information necessary to make the award ⁴	Opening held dated 10/01/11
Palmatir S.A. awarded the Bid No. K39607	11/03/2011
Palmatir S.A. was awarded by UTE resolution N° 11-307 ⁷ /Starting date	11/03/2011
Presentation of the Environmental Impact Study for obtaining environmental clearance Park Preview (Previous Environmental Authorization, "Autorización Ambiental Previa"-AAP)	April 11
Contract with the CDM consultant Zeroemission do Brasil Ltda.	13/05/11
ERPA signed with Zeroemission do Brasil Ltda.	13/05/11
The MEMBER (Ministry of Industry Energy and Mining) authorized Palmatir S.A. for power generation. (Resolution APG 31/08/2011)	31/08/2011
Power Purchase Agreement signed between UTE and Palmatir S.A., (PPA)	14/09/2011
GSP start	05/11/2011
CDM stakeholder consultation	14/11/2011 and 16/11/2011
ERPA transfer to Zeroemissions Technologies, S.A.	17/01/2012
CDM Consultancy services transfer to Zeroemissions Technologies, S.A.	17/01/2012
EPC ("Engineering, Procurement and Construction") contract for the construction of the windfarm.	17/02/2012
AAP approval	18/06/2012

⁷ The resolution was presented to the DOE



Milestones	Date
National Approval (Aprobación Nacional)	30/07/2012
Start of construction	29/08/2012
Estimated start-up	November 2013

Table 6: Milestones of the project**Step 1: Identification of alternatives to the project activity consistent with current laws and regulations**

As per the clause 105 of CDM validation and verification manual version 01.2 the PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required.

The proposed project is a new grid-connected renewable power plant, the electricity supplied by the proposed project will be delivered to the national electric network, and methodology ACM0002 (version 13.0.0) has clearly prescribed the baseline scenario for the project activity, therefore, no further analysis is required for the identification of alternatives to the project activity.

Step 2: Investment analysis***Sub-step 2a. Determine appropriate analysis method***

The project activity will generate economic benefits to the project developer, apart from the CDM incomes. Hence according to the “[Tool for the demonstration and assessment of additionally](#)” the simple cost analysis (option I) is not applicable. There are two possible investment analysis methods to choose: investment comparison analysis (option II) and benchmark analysis (option III).

According to the Tool, if the alternative to the CDM project activity does not include investment of comparable scale, the Option III must be applied.

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

According to the “Guideline on the assessment of investment analysis”, version 5, EB 62, the “default values for the expected return on equity” for the group 1 (1. Energy industries) in Uruguay expressed in its annexe is 12.75%. The Guideline indicates that the default value for the expected return on equity can be converted to real term values when an investment analysis is carried out in nominal terms by adding the inflation rate. The average forecasted inflation rate for the host country published by the IMF (International Monetary Fund) for the next five years after the start of the project has been used, following the guidelines.

In the following link the information about the inflation rate can be found:

<http://www.imf.org/external/pubs/ft/weo/2012/02/weodata/weorept.aspx?sy=2010&ey=2017&scsm=1&sd=1&sort=country&ds=.&br=1&pr1.x=72&pr1.y=15&c=298&s=PCPIPCH&grp=0&a=>



2012	2013	2014	2015	2016
7.901	7.613	7.081	6.015	6.031

In this case, the average for 2012-2016 of this rate is 6.93%.

Then, the benchmark is the default values for the expected return on equity plus the average of the Uruguayan inflation rate for 2012-2016:

Benchmark equity IRR: 19.68% (Financial Benchmark)

This value has been considered in order to assess the financial indicator.

Sub-step 2b: Option III. Apply benchmark analysis and Sub-step 2c: Calculation and comparison of financial indicators

Based on the calculation of the proposed project's cash flow in the financial assessment, the equity Internal Rate of Return (Equity IRR) of the proposed project is 10.3%.

The following assumptions have been considered for the investment analysis:

The main parameters are:

Main parameters		
	Unit	
Installed capacity	MW	50.00 ⁸
Estimated output	MWh/year	176,700 ⁹
Starting Price	USD/MWh	86.60 ¹⁰
Capacity factor (P50)		40.53 ¹¹
Project Lifetime	years	20

Table 7: Main parameters

⁸ Resolution n° 11-307

⁹ The estimated energy output was calculated using the load factor (P50) established in the Wind Study executed by Garrad Hassan.

¹⁰ The price was offered by Palmatir S.A. to UTE based on the internal feasibility study report and finally included in the Resolution n° 11-307

¹¹ The capacity factor is the one indicated in the Wind Study executed by Garrad Hassan



The construction and financial parameters are:

Construction and financial parameters		
Local Works (Commercial offer for the EPC)	397,777,306 Pesos Uruguayos ¹²	22,076,505 USD
Procurement (local and imported)(Commercial Offer for the EPC)		99,742,495 USD
Total Investment Construction (Local works and Procurement)		121,819,000 USD
	Exit fee (City Bank) 200,000\$ Advisory fee (City Bank) 750,000\$ Up front fee (Bridge loan) 1% 500,000\$ Ficus Remuneration 274,000\$ Up front fee (ECA loan without ECA IDC and Premium fee) 1,25% 918,000\$ Comprasion bond (3% annual 1,5 years) 352,000\$ IDC Bridge 1,700,000\$ Due dilligence cost 300,000\$ Commitment fee 26,000\$ Total 5 ,020,000\$	
Bridge Loan Interests, IDC Paid & Fees ¹³		5,020,000 USD
Premium Fee ¹⁴		8,444,000 USD
Interest During Construction		1,827,000 USD
Total Financial Investment		15,291,000 USD
Total Investment		137,110,000 USD

Table 8: Financial parameters

With these pamateres, the Equity IRR posts tax, (without including the CER income, which price has been estimated in 17.16 USD per CER for internal consideration in the financial assesment but without relation with the calculus of the equity IRR) stated in the financial assesment is 10.3%. The following table summarizes the benchmark and the equity IRR values:

¹² The local works are in Uruguayan pesos in the commercial offer. The amount was translate to USD to have a total price in USD. The exchange rate used in the financial assesment was based on the estimation of the USD/Uruguayan pesos rate, the consumer price index and the local industrial price index because the price for every the local works milestone payment has to be calculated depending on theses three parameters on the month of the payment. The Local Works price is, therefore, a conservative estimation.

¹³ PP financial internal assessment with bank data, included in the financial assesment.

¹⁴ The Premium Fee was the 11,5% of the sum of the principal loan.

Economic Results	
Equity IRR (%) without CER's sales	10.3 %
Financial Benchmark (%)	19.68%

Table 9: IRR results

Without the sales of CERs the Equity IRR is 10.3%, therefore lower than the Financial Benchmark. Thus the Project is not considered to be financially attractive.

Sub-step 2d. Sensitivity Analysis

The sensitivity analysis should show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions and is a frequently used method for assessing the perceived uncertainties by identifying the potential changing ranges of some key elements and potential impacts of such changes on the economic model of the Project.

According to the UNFCCC “Guidance on the Assessment of Investment Analysis”, version 5, EB 62, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation (all parameters varied need not necessarily be subjected to both negative and positive variations of the same magnitude), and the results of this variation should be presented in the PDD and be reproducible in the associated spreadsheets.

For the Project and in line with the requirements of the relevant guidance, four parameters were selected as sensitive factors to check out the financial attractiveness: below explains the robustness of the main elements of financial analysis.

Sensitive factors:

1. Investment.
2. Electricity price.
3. O&M
4. PLF

The following table shows the result of the sensitivity analysis.

Equity IRR (%) without CERs sales	-10%	-5%	0%	5%	10%
1.- Investment	14.13%	11.96%	10.30%	8.98%	7.88%
2.- Electricity Price	7.29%	8.71%	10.30%	12.31%	14.31%
3.- O&M	10.58%	10.44%	10.30%	10.17%	10.03%
4.-PLF	7.23%	8.75%	10.30%	11.89%	13.51%
5.-Financial Benchmark (%) Guides Assessment Investment Analysis	19.68%	19.68%	19.68%	19.68%	19.68%

Table 10: Sensitive analysis (1)

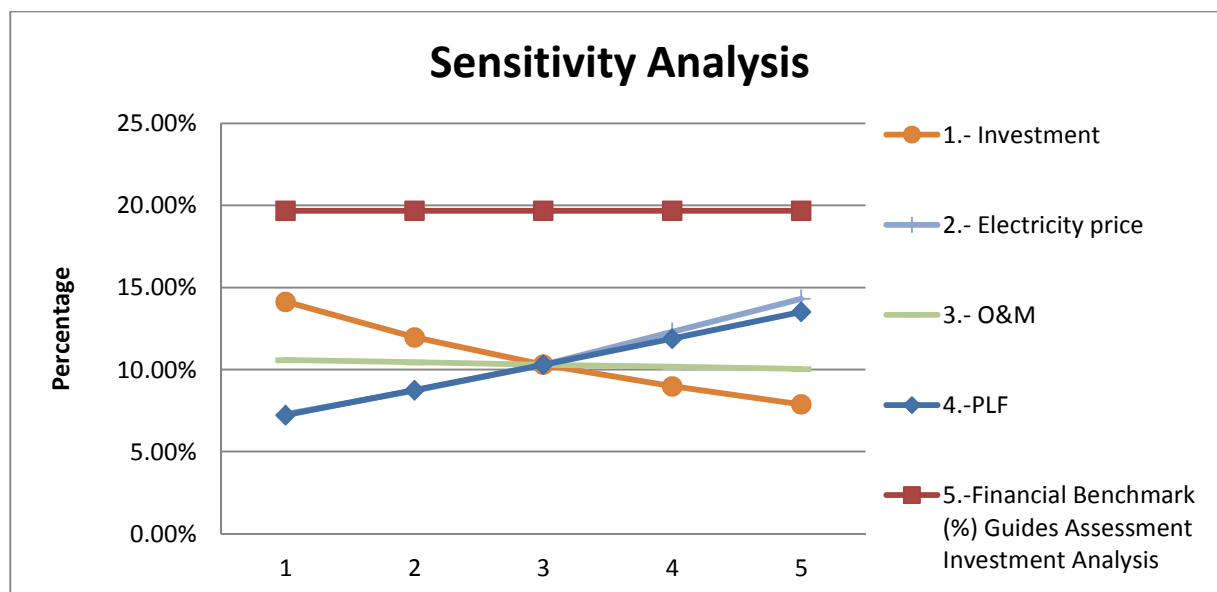


Table 11: Sensitive analysis (2)

As shown in the figure above, the equityIRR remains below the financial benchmark even under the most optimistic conditions of a 10% increase in electricity tariff- PLF or 10% reduction in total investment or O&M Cost.

- **Investment Costs Reduction**

As indicated in the study "Analysis of Profitability for Wind Farms in Uruguay" ¹⁵ prepared by the National Directorate of Energy the effect of variation in the cost of the investment on the IRR, for a 50MW wind farm for different energy prices and investment costs per MW installed is as follows:

		IRR		
		Investment (miles of USD/MW installed)		
		1600	1900	2200
Price USD/Mwh	79	16.1%	11.3%	7.9%
	85	18.3%	13.2%	9.5%
	88	19.2%	14.1%	10.4%

Table 12: IRR table for different analysis (Source: "Analysis of Return for Wind Farms in Uruguay", National Directorate of Energy).

For the electricity tariff applied in the proposed project activity, 86.60 USD/ MWh and an investment cost of 2,742 USD/kW installed the IRR remains below the benchmark (Financial Benchmark=19.68%).

¹⁵ <http://www.energieolica.gub.uy/uploads/licitacion%202011/evaluacioneconomicaweb.pdf>



In the proposed project activity, the investment costs should decrease to the 82.11% in order to make the IRR cross the benchmark.

- **Electricity tariff:**

To get the benchmark (Financial Benchmark=19.68%) the purchase price of energy should be increased by UTE over 119% (103 \$/MWh) from the tariff established in the bid award. This is unlikely as the electricity tariff is established in the bid award.

- **Operation and Maintenance Cost Reduction**

O&M costs are expected to increase over the time according to the quotations provided by the O&M provider. These costs consist basically of those costs related to human resources and those related to materials for maintenance. The proposed benchmark (Financial Benchmark=19.68%) is impossible to get even without operation and maintenance costs.

- **Plant Load factor**

To reach the benchmark (Financial Benchmark=19.68%) the PLF should increase to the 128.53% of the actual PLF. The PLF has been estimated by a qualified party in the wind study and has been confirmed by the Ministry of Energy¹⁶ of Uruguay. Hence, it is not expected such increase.

In the table below these data are summarize:

	equity IRR	Variation
1.- Investment	19.67%	82.11%
2.- Electricity price	19.69%	119.00%
3.- O&M	13.32%	0.00%
4.-PLF	19.66%	128.53%

Sensitivity
benchmark.Data from
the financial assesment

Outcome of Step 2: According to the sensitivity analysis, the proposed project activity is unlikely to be financially attractive.

Step 3: Barrier analysis

Project Proponents chose to undertake Step 2 Investment Analysis.

Step 4: Common practice analysis

The analysis on the common practice has been developed in accordance with the provisions in the Guidelines on Common Practice (Version 02.0, EB69, Annex 8) as follows:

Applicable geographical area

¹⁶ <http://www.energiiaeolica.gub.uy/index.php?page=mediciones-de-viento>



According to the Guidelines on Common Practice, the applicable geographical area covers the host country as a default.

Therefore, the applicable geographical area is Uruguay.

Measure

Measure (for emission reduction activities) - a broad class of greenhouse gas emission reduction activities possessing common features. Four types of measures are currently covered in the framework:

- (a) Fuel and feedstock switch;
- (b) Switch of technology with or without change of energy source (including energy efficiency improvement);
- (c) Methane destruction;
- (d) Methane formation avoidance.

The proposed project activity consists on the implementation and operation of a greenfield wind power project which will generate electricity that will be supplied to the Uruguayan grid, thus replacing the same amount of energy which, in the absence of the project activity, would have been generated by other carbon intensive sources. Hence, it corresponds to measure (a) above.

Output

According to the Guidelines, output is defined as “goods or services with comparable quality, properties, and application areas (e.g. clinker, lighting, residential cooking)”.

The proposed project activity will be compared to other proposed project activities which would provide a comparable amount of electricity to the grid.

Different technologies

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):

- (a) Energy source/fuel;
- (b) Feed stock;
- (c) Size of installation (power capacity):
 - Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
 - Small (as defined in paragraph 28 of Decision 1/CMP.2);
 - Large



(d) Investment climate in the date of the investment decision, inter alia:

- Access to technology;
- Subsidies or other financial flows;
- Promotional policies;
- Legal regulations

(e) Other features, inter alia.

- Unit cost of output (unit costs are considered different if they differ by at least 20 %);

The proposed project activity will be compared to other large scale wind power projects.

Approach for common practice:

As per the Guidelines on Common Practice, the PP shall follow the following steps to demonstrate that the proposed project is not common practice.

- Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.
- Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all} . Registered CDM project activities shall not be included in this step;
- Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff} .
- Step 4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.
- The proposed project activity is a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3.

Step 1: Applicable output range:

The installed capacity of the proposed project activity is 50MW.

The applicable output range is from 25 MW to 75 MW;

Step 2: Identification of plants in the applicable geographical area that deliver the same output, within the applicable output range.

Between 25MW and 75 MW exist the following power plants (table 13):

- Central Batlle Unit 3, with 50 MW installed capacity;
- Central Batlle Unit 4, with 50 MW installed capacity;



Both power plants use as fuel carbon and fuel-oil. Hence, no wind power projects exist in Uruguay with installed capacity between 25 and 75MW.

There are no similar projects in Uruguay according to the applicable conditions in the Guidelines

Step 3: Identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff} .

As there are no similar projects, $N_{diff} = N_{all}$.

Step 4: Calculate factor $F = 1 - N_{diff}/N_{all}$.

The proposed project activity is a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all} - N_{diff}$ is greater than 3

As $N_{diff} = N_{all}$, $N_{diff}/N_{all} = 1$ and $F = 1 - 1 = 0$.

Hence, as per the Guidelines on Common Practice, it is demonstrated that the proposed project activity is not common practice in Uruguay.

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

According to the analysis above, there are no similar options to the proposed project activity in Uruguay.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:
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As per by the approved consolidated methodology ACM0002 (version 13.0.0), the equations utilized to calculate the project emissions, baseline emissions, leakage and emission reductions are described below.

Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of the project are emissions arising due to activities such as power plant construction. These emissions sources are neglected.

Project emissions

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

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

(1)



Where:

PE_y = Project emissions in year y (tCO₂e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO₂e/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO₂e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO₂e/yr)

As this proposed project activity corresponds to a new wind power plant without fossil fuel consumption and it does not involve any geothermal and/or hydro power plants, the project emission is zero.

Baseline emissions

Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of the new grid-connected power plants. Thus, baseline emissions are calculated as follows:

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

(2)

Where:

BE_y = Baseline emissions in year y (tCO₂/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 CO₂ emission factor for grid connected power generation in year y calculated using version 2.2.1 of the “Tool to calculate the emissions factor for an electricity system” (tCO₂/MWh)

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for (a) greenfield plants, (b) retrofits and replacements, and (c) capacity additions. Since this project activity is the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project activity, the option (a) was selected:



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

$$EG_{PJ,y} = EG_{facility,y} \quad (3)$$

Where:

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

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

Calculation of $EF_{grid,CM,y}$

Combined margin CO₂ emissions factor is calculated in accordance with the “Tool to calculate the emission factor for an electricity system” (version 02.2.1). This methodological tool determines the CO₂ emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the combined margin emission factor (CM) of the electricity system. The CM is the result of a weighted average of two emission factors pertaining to the electricity system: the operating margin (OM) and the build margin (BM). The operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed CDM project activity. The build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed CDM project activity.

The procedures of this methodological tool are described in the following steps:

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. The spatial extent of the project boundary includes the project site which is connected to the National Interconnected System.

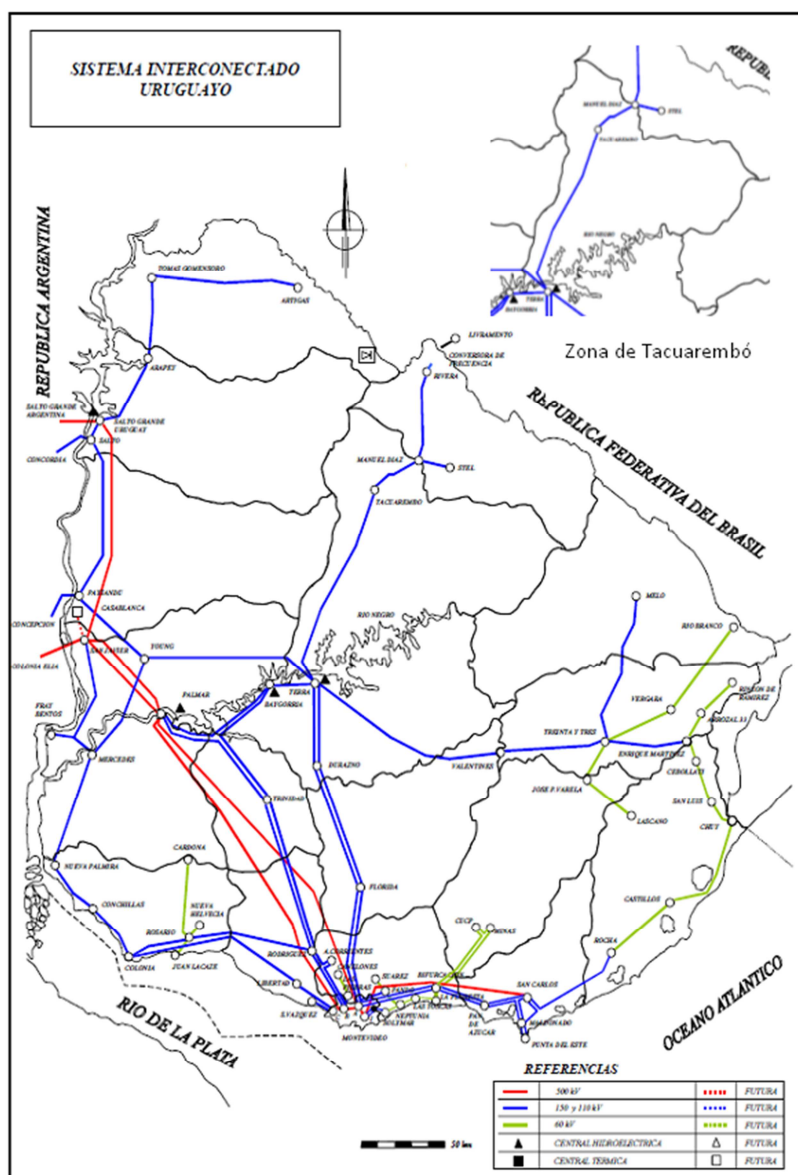


Figure 5: National Grid of Uruguay. (I)

In accordance to the methodological tool used to calculate the emission factor, Step 1, energy imports from the interconnected networks of Argentina and Brazil, are taken into consideration for the calculations with an emission factor of 0 tons CO₂ per MWh. For the calculations we used the information provided by the Administrator of the Electrical Market (ADME) and Office Uruguay national charges (UTE), with daily information time economic dispatch of generation system¹⁷.

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

¹⁷ <http://www.adme.com.uy/>

Project participants may choose 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.

Option I is chosen to calculate OM and BM.

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

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

- (a) Simple OM; or
- (b) Simple adjusted OM; or
- (c) Dispatch data analysis OM; or
- (d) Average OM.

Any above method can be utilized. However, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation, in Uruguay the percentage of low cost / must run units of the total generation (hydro, wind, low-cost biomass, and solar), over the five most recent years, is greater than 50 %. Therefore, the simple OM method cannot be used.

The percentage of low cost / must run units of the total generation, over the five years considered is:

	low cost/ must run units(GWh/year)	Total (GWh/year)	%
2006	6,334	8,221	77.05%
2007	8,304	9,491	87.49%
2008	5,404	8,735	61.87%
2009	6,401	9,162	69.86%
2010	8,425	9,749	86.42%

Datas: for 2006 and 2007 from " Cálculo del factor de emisión de CO2 del sistema eléctrico uruguayo". For the rest of the year EF calculus.

The **Simple adjusted OM** was selected by the proponent to calculate the operating margin, using the **ex-ante option** for the data vintages, of Ministry of Industry, Energy and Mining has been updated and published by the National Directorate of Energy¹⁸.

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

¹⁸ [Dirección Nacional de Energía](#)

The simple adjusted OM emission factor ($EF_{grid,OM-adj,y}$) is a variation of the simple OM, where the power plants / units (including imports) are separated in low-cost/ must-run power sources (k) and other power sources (m). As under Option A of the simple OM, it is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

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

Where:

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO2 emission factor in year y (tCO2/MWh)

λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y¹⁹

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

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

$EF_{EL,m,y}$ = CO2 emission factor of power unit m in year y (tCO2/MWh)

$EF_{EL,k,y}$ = CO2 emission factor of power unit k in year y (tCO2/MWh)

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

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

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

For the calculation of emission factor of each power Option A1 was because data on fuel consumption and electricity generation is available:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$ = CO2 emission factor of power unit m in year y (tCO2/MWh)

$FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)

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

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

i = All fossil fuel types combusted in power unit m in year y

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

The following table lists the plants that are part of the Uruguayan Interconnected System.

¹⁹ See Annex 3: graphics for calculation of λ_y .



	Plant	Type	Technology	Fuel	In operation from	Installed Power (MW)
low cost / must run units	Import from Brazil (<a data-bbox="395 427 791 488" href="http://www.miem.gub.uy/gxpsites/hgxpp001?5,6,294,O,S,O,MNU;E;94;1;MNU;,">http://www.miem.gub.uy/gxpsites/hgxpp001?5,6,294,O,S,O,MNU;E;94;1;MNU;,")	----	----	----	2001	120
	Import from Argentina (<a data-bbox="395 495 791 555" href="http://www.miem.gub.uy/gxpsites/hgxpp001?5,6,294,O,S,O,MNU;E;94;1;MNU;,">http://www.miem.gub.uy/gxpsites/hgxpp001?5,6,294,O,S,O,MNU;E;94;1;MNU;,")	----	----	----	1979	2000
	"Sierra de los Caracoles" (first 10MW) (<a data-bbox="395 562 791 622" href="http://www.ute.com.uy/info_institucional/patrimonio/caracoles.htm">http://www.ute.com.uy/info_institucional/patrimonio/caracoles.htm)	Wind	-----	-----	10/05/2008	10
	Gabriel Terra (<a data-bbox="395 629 791 689" href="http://www.ute.com.uy/empresa/lineas/generacion/central_hid_Terra.htm">http://www.ute.com.uy/empresa/lineas/generacion/central_hid_Terra.htm)	Hydraulic	-----	-----	1945 (renew. 1994-97)	152
	Baygorria (<a data-bbox="395 696 791 757" href="http://www.ute.com.uy/empresa/lineas/generacion/central_hid_baygorria.htm">http://www.ute.com.uy/empresa/lineas/generacion/central_hid_baygorria.htm)	Hydraulic	-----	-----	1960	108
	Salto Grande (Uruguay) (<a data-bbox="395 763 791 824" href="http://www.saltogrande.org/interior.php?p=html/menutop/energia/generacion/datos_central_unidades_generadas.html&id=94">http://www.saltogrande.org/interior.php?p=html/menutop/energia/generacion/datos_central_unidades_generadas.html&id=94)	Hydraulic	-----	-----	1979	945
	Constitución (Palmar) (<a data-bbox="395 831 791 891" href="http://www.ute.com.uy/empresa/lineas/generacion/central_hid_Constitucion.htm">http://www.ute.com.uy/empresa/lineas/generacion/central_hid_Constitucion.htm)	Hydraulic	-----	-----	1982	333
	Nuevo Manantial (<a data-bbox="395 898 791 958" href="http://www.ute.com.uy/info_institucional/memoria/Memoria_2009.pdf">http://www.ute.com.uy/info_institucional/memoria/Memoria_2009.pdf). (<a data-bbox="395 965 791 1025" href="http://cdm.unfccc.int/filestorage/R/K/J/RKJHLFSB4G06VP3ZWDMIOXEC79U12Q/PDD_Nuevo%20Manantial%20and%20Agroland.pdf?t=ZG18bWJ4ZmoxfDBsXZel1OnYZ6AaTbTIVV-l">http://cdm.unfccc.int/filestorage/R/K/J/RKJHLFSB4G06VP3ZWDMIOXEC79U12Q/PDD_Nuevo%20Manantial%20and%20Agroland.pdf?t=ZG18bWJ4ZmoxfDBsXZel1OnYZ6AaTbTIVV-l) section A.4.2.	Wind	-----	-----	2009	13
	Agroland (<a data-bbox="395 1032 791 1093" href="http://www.ute.com.uy/info_institucional/memoria/Memoria_2009.pdf">http://www.ute.com.uy/info_institucional/memoria/Memoria_2009.pdf). (<a data-bbox="395 1099 791 1160" href="http://cdm.unfccc.int/filestorage/R/K/J/RKJHLFSB4G06VP3ZWDMIOXEC79U12Q/PDD_Nuevo%20Manantial%20and%20Agroland.pdf?t=ZG18bWJ4ZmoxfDBsXZel1OnYZ6AaTbTIVV-l">http://cdm.unfccc.int/filestorage/R/K/J/RKJHLFSB4G06VP3ZWDMIOXEC79U12Q/PDD_Nuevo%20Manantial%20and%20Agroland.pdf?t=ZG18bWJ4ZmoxfDBsXZel1OnYZ6AaTbTIVV-l) section A.4.2.	Wind	-----	-----	2009	0.45
	Las Rosas de Maldonado (Data extracted from UNFCCC registered project data) (<a data-bbox="395 1167 791 1227" href="http://cdm.unfccc.int/filestorage/6/O/M/6OMYBGEV DL13NQSOCH4FAJW5ZP2XT9/PDD_Caracoles_10MW_Wind_Farm.pdf?t=bEp8bWMxNDJ1fDCf6b5IF6Cznu-8_VdkWESS">http://cdm.unfccc.int/filestorage/6/O/M/6OMYBGEV DL13NQSOCH4FAJW5ZP2XT9/PDD_Caracoles_10MW_Wind_Farm.pdf?t=bEp8bWMxNDJ1fDCf6b5IF6Cznu-8_VdkWESS)	Biogas	-----	-----	2005	1.2
	Bioener S.A. (<a data-bbox="395 1234 791 1294" href="http://www.ute.com.uy/pags/Institucional/documentos/Memoria_2009.pdf">http://www.ute.com.uy/pags/Institucional/documentos/Memoria_2009.pdf)	Biomass	-----	-----	2009	12
	Fenirol (<a data-bbox="395 1301 791 1361" href="http://www.ute.com.uy/pags/Institucional/documentos/Memoria_2009.pdf">http://www.ute.com.uy/pags/Institucional/documentos/Memoria_2009.pdf)	Biomass	-----	-----	2009	10



other power sources	Central Batlle Unit 3 (http://www.ute.com.uy/empresa/lineas/generacion/central_ter_batlle.htm)	Thermal	Steam turbine	Fuel oil - coal	1955	50
	Central Batlle Unit 4 (http://www.ute.com.uy/empresa/lineas/generacion/central_ter_batlle.htm)	Thermal	Steam turbine	Fuel oil - coal	1957	50
	Central Batlle unit 5 (http://www.ute.com.uy/empresa/lineas/generacion/central_ter_batlle.htm)	Thermal	Steam turbine	Fuel oil	1970	88
	Central Batlle 6 (http://www.ute.com.uy/empresa/lineas/generacion/central_ter_batlle.htm)	Thermal	Steam turbine	Fuel oil	1975	125
	CTR (La Tablada) (http://www.ute.com.uy/empresa/lineas/generacion/central_ter_tablada.htm)	Thermal	Gas turbine	Diesel	1991	226
	Central de Respaldo Punta Tigre (I to VI) (http://www.ute.com.uy/pags/Institucional/documentos/Memoria_2008.pdf) (pag 16)	Thermal	Steam turbine	Natural Gas/Gas oil	2006-2008	300
	CT Motores Batlle (http://www.ute.com.uy/pags/Institucional/documentos/borrador%20Memoria%20anual%202010.pdf)	Thermal	alternative engine	Diesel	2010	81
	Zenda (Others) (Data extracted from UNFCCC registered project data) (http://cdm.unfccc.int/filestorage/6/O/M/6OMYBGEV DL13NQSOCH4FAJW5ZP2XT9/PDD_Caracoles_10 MW_Wind_Farm.pdf?t=bEp8bWMxNDJ1fDCf6b5IF6Cznu-8_VdkWESS)	Thermal	Gas turbine	Gas	05/02/2008	3.2
	San Borja (Others) (Data extracted from UNFCCC registered project data) (http://cdm.unfccc.int/filestorage/6/O/M/6OMYBGEV DL13NQSOCH4FAJW5ZP2XT9/PDD_Caracoles_10 MW_Wind_Farm.pdf?t=bEp8bWMxNDJ1fDCf6b5IF6Cznu-8_VdkWESS)	Thermal		Gas oil	(1999) 2005	(1.26) 1.54
	Rivera (Others) (Data extracted from UNFCCC registered project data) (http://cdm.unfccc.int/filestorage/6/O/M/6OMYBGEV DL13NQSOCH4FAJW5ZP2XT9/PDD_Caracoles_10 MW_Wind_Farm.pdf?t=bEp8bWMxNDJ1fDCf6b5IF6Cznu-8_VdkWESS)	Thermal		Gas oil	1995	4.3
	Botnia (Others) (unfccc registered project) (http://cdm.unfccc.int/filestorage/5/K/0/5K0RW1P7G DI8EBMUC92XS6NL VYAT QF/Fray%20Bentos%20 Biomass%20Power%20Generation%20Project%20PD D%20v5.1.1?t=Ymx8bWMxNDJ1fDCx8rwmRjqz3T wk 5f-ro01I)	Thermal	Black liquor	Biomass	25/07/2007	161
	Maldonado ((Extracted from UNFCCC registered project data))(http://cdm.unfccc.int/filestorage/6/O/M/6OMY BGEVDL13NQSOCH4FAJW5ZP2XT9/PDD_Caracol es_10MW_Wind_Farm.pdf?t=bEp8bWMxNDJ1fDCf 6b5IF6Cznu-8_VdkWESS)	Thermal	Steam turbine	Diesel	1982	20

Table 13: Uruguayan Power Plants

In determining λ_y only grid power units (and no off-grid power plants) were considered.

The parameter λ_y is defined as follows:

$$\lambda_y (\%) = \frac{\text{Number of hours low - cost / must - run sources are on the margin in year } y}{8760 \text{ hours per year}} \quad (5)$$

Lambda (λ_y) was calculated according the following steps:

- Step (i) Plot a load duration curve. Collect chronological load data (typically in MW) for each hour of the year y , and sort the load data from the highest to the lowest MW level. Plot MW against 8,760 hours in the year, in descending order.
- Step (ii) Collect power generation data from each power plant / unit. Calculate the total annual generation (in MWh) from low-cost/must-run power plants / units (i.e. $\sum_k EG_{k,y}$).
- Step (iii) Fill the load duration curve. Plot a horizontal line across the load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from low-cost/must-run power plants / units (i.e. $\sum_k EG_{k,y}$).
- Step (iv) Determine the “Number of hours for which low-cost/must-run sources are on the margin in year y ”. First, locate the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i). The number of hours (out of the total of 8,760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin.

The results for the three most recent years and weighted average are presented in the table below:

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO_2 emission factor in year y (tCO_2/MWh)		
$EF_{grid,OM-adj,y}$ 2008	$EF_{grid,OM-adj,y}$ 2009	$EF_{grid,OM-adj,y}$ 2010
0.629	0.762	0.517
Weighted average		
0.634		

Table 14: adjusted OM emission factor

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

In terms of vintage of data, project participants can choose between one of the following two options:

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.



- Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

In terms of vintage of data, **Option 1** was selected:

For the first crediting period, calculate the build margin emission factor ex ante is 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.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

- 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 ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET-5-units}$, in MWh);
- Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total} , in MWh).

SET 5-units									
SET-sample	Type	Technology	Fuel	Installed Power (MW)	Generation 2010 MWh (most recent year)	EF _{set,m,y}	EG _{m,y} x EF _{set,m,y}	In operation from	Excluded / Included on BM calculation
CT Motores Batlle	Thermal	----	Fuel oil	80	271,119	0.61	166,237	2010	Included
Bioener	Biomass	----	----	12	13,786	----	----	13/08/2009	Included
Fenrol	Biomass	----	----	10	16,848	----	----	01/07/2009	Included
"Sierra de los Caracoles"	Wind	----	----	10	34,223	----	----	2008	Included
Zenda	Thermal	----	Gas	3.20	4,570	0.66	3,028	2008	Included
AEG SET-5-units					340,546				
AEG Total					9,118,000				
					4%				

- 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) ($SET_{20\%}$) and determine their annual electricity generation ($AEG_{SET-20\%}$, in MWh);



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SET- $\geq 20\%$, in MWh

SET-sample	Type	Technology	Fuel	Installed Power (MW)	Generation 2010 MWh (most recent year)	EF _{EL,m,y}	EG _{m,y} x EF _{EL,m,y}	In operation from	Excluded / Included on BM calculation
CT Motores Battle	Thermal	----	Fuel oil	80.00	271,119	0.61	166,237	2010	Included
Bioener	Biomass	----	----	12	13,786	----	----	13/08/2009	Included
Feniról	Biomass	----	----	10	16,848	----	----	01/07/2009	Included
"Sierra de los Caracoles"	Wind	----	----	10.00	34,223	----	----	2008	Included
Zenda	Thermal	----	Gas	3.20	4,570	0.66	3,028	2008	Included
Central de Respaldo Punta Tigre (I to VI)	Thermal	Steam turbine	Gas oil/Natural Gas	300.00	407,534	0.66	269,478	2006-2008	Included
Las Rosas de Maldonado	Biogas	----	Landfill Gas	1.20	1,024	0.64	659	2005	Included
San Borja	Thermal	----	Gas oil	(1.26) 1.54	22	0.68	14	(1999) 2005	Included (>10 yrs)
Rivera	Thermal	----	Gas oil	4.30	20	1.20	13	1995	Included (>10 yrs)
CTR (La Tablada)	Thermal	Steam turbine	Gas oil	226.00	99,192	0.89	87,928	1991	Included (>10 yrs)
Constitución (Palmar)	Hydro	----	----	333.00	1,926,609	----	----	1982	Included (>10 yrs)

AEG SET- $\geq 20\%$ 2,774,946

AEG Total 9,118,000

30%

- From SET_{5-units} and SET_{20%} select the set of power units that comprises the larger annual electricity generation (SET sample);

SET_{20%} was selected because comprises the larger annual electricity generation (SET_{sample});

SET Sample ©

SET-sample	Type	Technology	Fuel	Installed Power (MW)	Generation 2010 MWh (most recent year)	EF _{EL,m,y}	EG _{m,y} x EF _{EL,m,y}	In operation from	Excluded / Included on BM calculation
CT Motores Battle	Thermal	----	Fuel oil	80.00	271,119	0.61	166,237	2010	Included
Bioener	Biomass	----	----	12	13,786	----	----	13/08/2009	Included
Feniról	Biomass	----	----	10	16,848	----	----	01/07/2009	Included
"Sierra de los Caracoles"	Wind	----	----	10.00	34,223	----	----	2008	Included
Zenda	Thermal	----	Gas	3.20	4,570	0.66	3,028	2008	Included
Central de Respaldo Punta Tigre (I to VI)	Thermal	Steam turbine	Gas oil/Natural Gas	300.00	407,534	0.66	269,478	2006-2008	Included
Las Rosas de Maldonado	Biogas	----	Landfill Gas	1.20	1,024	0.64	659	2005	Included
CTR (La Tablada)	Thermal	Steam turbine	Gas oil	226.00	99,192	0.89	87,928	1991	Included (>10 yrs)
Constitución (Palmar)	Hydro	----	----	333.00	1,926,609	----	----	1982	Included (>10 yrs)

AEG SET Sample © 2,774,905

AEG Total 9,118,000

30%

- 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. In this case ignore steps (d), (e) and (f).

Units in SET sample started to supply electricity to the grid more than 10 years ago steps so next steps of the procedure are necessary.

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 activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new



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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-CDM}) the annual electricity generation (AEG_{SET-sample-CDM}, in MWh);

SET Sample CDM (D)									
SET-sample	Type	Technology	Fuel	Installed Power (MW)	Generation 2010 MWh (most recent year)	EF _{EL,m,y}	EG _{m,y} x EF _{EL,m,y}	In operation from	Excluded / Included on BM calculation
CT Motores Batlle	Thermal	----	Fuel oil	80.00	271,119	0.61	166,237	2010	Included
Bioener	Biomass	----	----	12	13,786	----	----	13/08/2009	Included
Fenrol	Biomass	----	----	10	16,848	----	----	01/07/2009	Included
"Sierra de los Caracoles"	Wind	----	----	10.00	34,223	----	----	2008	Included
Zenda	Thermal	----	Gas	3.20	4,570	0.66	3,028	2008	Included
Central de Respaldo Punta Tigre (I to VI)	Thermal	Steam turbine	Gas oil/Natural Gas	300.00	407,534	0.66	269,478	2006-2008	Included
Las Rosas de Maldonado	Biogas	----	Landfill Gas	1.20	1,024	0.64	659	2005	Included
Botnia, (Fray Bentos CDM Registered)	Thermal	----	Biomass	161.00	239,476	----	----	2010	Included (CDM registered)
Nuevos Manantiales (CDM registered)	Wind	----	----	13.00	6,322	----	----	2009	Included (CDM registered)
Agroland (CDM registered)	Wind	----	----	0.45	1,052	----	----	2009	Included (CDM registered)
CTR (La Tablada)	Thermal	Steam turbine	Gas oil	226.00	99,192	0.89	87,928	1991	Excluded (>10 yrs)
Constitución (Palmar)	Hydro	----	----	333	1,926,609	----	----	1,982	Excluded (>10 yrs)
AEG SET-Sample-CDM					993,850				
AEG Total					9,118,000				
					11%				

The annual electricity generation of that set is do not comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET-sample-CDM\ 20\%} \sim AEG_{total}$), then we have to use the next steps (e) and (f) of the procedure.

- Include in the sample group SET_{sample-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);

SET Sample CDM > 10 yrs E									
SET-sample	Type	Technology	Fuel	Installed Power (MW)	Generation 2010 MWh (most recent year)	EF _{EL,m,y}	EG _{m,y} x EF _{EL,m,y}	In operation from	Excluded / Included on BM calculation
CT Motores Batlle	Thermal	----	Fuel oil	80.00	271,119	0.61	166,237	2010	Included
Bioener	Biomass	----	----	12	13,786	----	----	13/08/2009	Included
Fenrol	Biomass	----	----	10	16,848	----	----	01/07/2009	Included
"Sierra de los Caracoles"	Wind	----	----	10.00	34,223	----	----	2008	Included
Zenda	Thermal	----	Gas	3.20	4,570	0.66	3,028	2008	Included
Central de Respaldo Punta Tigre (I to VI)	Thermal	Steam turbine	Gas oil/Natural Gas	300.00	407,534	0.66	269,478	2006-2008	Included
Las Rosas de Maldonado	Biogas	----	Landfill Gas	1.20	1,024	0.64	659	2005	Included
Botnia, (Fray Bentos CDM Registered)	Thermal	----	Biomass	161.00	239,476	----	----	2010	Included (CDM Registered)
Nuevos Manantiales (CDM registered)	Wind	----	----	13.00	6,322	----	----	2009	Included (CDM Registered)
Agroland (CDM registered)	Wind	----	----	0.45	1,052	----	----	2009	Included (CDM Registered)
CTR (La Tablada)	Thermal	Steam turbine	Gas oil	226.00	99,192	0.89	87,928	1991	Included (>10 yrs)
Constitución (Palmar)	Hydro	----	----	333.00	1,926,609	----	----	1982	Included (>10 yrs)
SET sample- CDM->10yrs					3,019,651				
AEG Total					9,118,000				
					33%				

Table 15: Set of power units, including power units registered as CDM project activities and power units that started to supply energy more than ten years ago and that started to supply electricity to the grid most recently ($SET_{\text{sample-CDM}>10\text{yrs}}$)

The sample group (SET_{sample}) of power units m used to calculate the build margin consists of the set of power units, including power units registered as CDM project activities, and 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 ($SET_{\text{sample-CDM}>10\text{yrs}}$).

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

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

Where:

$EF_{\text{grid,BM},y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

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

$EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)

m = Power units included in the build margin

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

In this project the $EF_{EL,m,y}$ was obtained from the Uruguay's ADME. The factors are calculated recently, and ADME usually update this information frequently.

The build Margin considered for the year 2010 has a final value of:

EF grid, BM, 2010
0.175

STEP 6. Calculate the combined margin emissions factor

The baseline emission factor shall be calculated as the weighted average of the OM emission factor and the BM emission factor, as follows:

$$EF_{\text{grid,CM},y} = W_{OM} * EF_{\text{grid,OM},y} + W_{BM} * EF_{\text{grid,BM},y}$$

Where:

$EF_{\text{grid,CM},y}$ = Combined margin CO₂ emission factor in year y (tCO₂/MWh);

$EF_{\text{grid,OM},y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh);

$EF_{\text{grid,BM},y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh);



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

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

For wind power generation activities, for the first and subsequent period should use the following default values:

$$W_{OM}=0.75$$

$$W_{BM}=0.25$$

The final value for $EF_{grid,CM,y}$ is:

$EF_{grid,CM,y} =$	0.5190
--------------------	---------------

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

Data / Parameter:	$EF_{grid, CM}$
Data unit:	tCO ₂ / MWh
Description:	Combined margin CO ₂ emission factor of the grid connected power generation in year y calculated using the “Tool to calculate the emission factor for an electricity system” version 02.2.1
Source of data used:	Despacho Nacional de Cargas (UTE) and ADME
Value applied:	0.519
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Combined Margin emission factor is calculated ex ante, as described in section B.6.1. / B.6.2/ B.6.3
Any comment:	

Data / Parameter:	EF_{OM}
Data unit:	tCO ₂ / MWh
Description:	Operating Margin CO ₂ emission factor of the grid connected power generation in year y calculated using the “Tool to calculate the emission factor for an electricity system” version 02.2.1.
Source of data used:	Despacho Nacional de Cargas (UTE) /UTE's Annual Report, 2008, 2009 & 2010 and ADME
Value applied:	0.634
Justification of the choice of data or description of measurement methods	The Simple adjusted OM was selected by the proponent to calculate the operating margin, using the ex-ante option for the data vintages, of Ministry of Industry, Energy and Mining has been updated and published by the National



and procedures actually applied :	Directorate of Energy ²⁰ .
Any comment:	

Data / Parameter:	EF _{BM,2010}
Data unit:	tCO ₂ / MWh
Description:	Build Margin CO ₂ emission factor of the grid connected power generation in year y calculated using the “Tool to calculate the emission factor for an electricity system” version 02.2.1.
Source of data used:	Despacho Nacional de Cargas (UTE) / UTE's Annual Report, 2010 and ADME
Value applied:	0.175
Justification of the choice of data or description of measurement methods and procedures actually applied :	As describes in Step 5 (Calculate the build margin (BM) emission factor) The sample group (SET sample) of power units <i>m</i> used to calculate the build margin consists of the set of power units, including power units registered as CDM project activities, and 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 (SET _{sample- CDM->10yrs}).
Any comment:	

²⁰ [Dirección Nacional de Energía](#)



Data / Parameter:	EF _{CO₂,m,i,y}																																																							
Data unit:	tCO ₂ /Mwh																																																							
Description:	CO ₂ emission factor of fossil fuel type <i>i</i> in year <i>y</i>																																																							
Source of data used:	UTE Annual Memory 2008, 2009 and 2010 and ADME- Specific consumptions of uruguayan generators																																																							
Value applied:	<table><thead><tr><th></th><th>Emission factor (tCO₂/MWh) 2008</th><th>Emission factor (tCO₂/MWh) 2009</th><th>Emission factor (tCO₂/MWh) 2010</th></tr></thead><tbody><tr><td></td><td>0.95</td><td>1.00</td><td>0.86</td></tr><tr><td>Central Batlle</td><td>0.78</td><td>0.83</td><td>0.81</td></tr><tr><td></td><td>0.78</td><td>0.80</td><td>0.83</td></tr><tr><td>Central Batlle</td><td>0.84</td><td>0.87</td><td>0.83</td></tr><tr><td>CTR (la Tablada)</td><td>0.84</td><td>0.86</td><td>0.89</td></tr><tr><td>Central de Respaldo Punta Tigre (I to VI)</td><td>0.34</td><td>0.67</td><td>0.66</td></tr><tr><td>Maldonado</td><td>1.22</td><td>1.31</td><td>1.22</td></tr><tr><td>CT Motores Batlle</td><td>-</td><td>0.60</td><td>0.61</td></tr><tr><td>Zenda</td><td>0.79</td><td>2.14</td><td>0.66</td></tr><tr><td>San Borja</td><td>0.60</td><td>0.68</td><td>0.68</td></tr><tr><td>Rivera</td><td>1.06</td><td>1.20</td><td>1.20</td></tr><tr><td>Las Rosas de Maldonado</td><td>0.64</td><td>0.64</td><td>0.64</td></tr></tbody></table>					Emission factor (tCO ₂ /MWh) 2008	Emission factor (tCO ₂ /MWh) 2009	Emission factor (tCO ₂ /MWh) 2010		0.95	1.00	0.86	Central Batlle	0.78	0.83	0.81		0.78	0.80	0.83	Central Batlle	0.84	0.87	0.83	CTR (la Tablada)	0.84	0.86	0.89	Central de Respaldo Punta Tigre (I to VI)	0.34	0.67	0.66	Maldonado	1.22	1.31	1.22	CT Motores Batlle	-	0.60	0.61	Zenda	0.79	2.14	0.66	San Borja	0.60	0.68	0.68	Rivera	1.06	1.20	1.20	Las Rosas de Maldonado	0.64	0.64	0.64
	Emission factor (tCO ₂ /MWh) 2008	Emission factor (tCO ₂ /MWh) 2009	Emission factor (tCO ₂ /MWh) 2010																																																					
	0.95	1.00	0.86																																																					
Central Batlle	0.78	0.83	0.81																																																					
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Central Batlle	0.84	0.87	0.83																																																					
CTR (la Tablada)	0.84	0.86	0.89																																																					
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Zenda	0.79	2.14	0.66																																																					
San Borja	0.60	0.68	0.68																																																					
Rivera	1.06	1.20	1.20																																																					
Las Rosas de Maldonado	0.64	0.64	0.64																																																					
Justification of the choice of data or description of measurement methods and procedures actually applied :	The values to calculate EF _{m,y} was obtained from the ADME and for the UTE annual memories: http://www.ute.com.uy/pags/Institucional/memoria_anual.html .																																																							
Any comment:	-----																																																							

Data / Parameter:	$EG_{m,y}$, EG_y , $EG_{k,y}$
Data unit:	MWh
Description:	$EG_{m,y}$:Net electricity generated and delivered to the grid by power plant / unit <i>m</i> , <i>k</i> (or in the project electricity system in case of EG_y) in year <i>y</i>
Source of data used:	Despacho Nacional de Cargas (UTE) and ADME
Value applied:	Hourly net generation
Justification of the choice of data or description of measurement methods and procedures actually applied :	National values available.
Any comment:	-----



Data / Parameter:	w_{OM}
Data unit:	Fraction
Description:	Weighting of operating margin emissions factor
Source of data used:	“Tool to calculate the emission factor for an electricity system”, Version 2.2.1
Value applied:	75%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default value for wind power plants
Any comment:	This value will be applied in the subsequent crediting periods.

Data / Parameter:	w_{BM}
Data unit:	Fraction
Description:	Weighting of build margin emissions factor
Source of data used:	“Tool to calculate the emission factor for an electricity system”, Version 2.2.1
Value applied:	25%
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default value for wind power plants
Any comment:	This value will be applied in the subsequent crediting periods.

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

Based on the applied methodology, emission reductions are calculated according to the following formula:

$$ER_y = EG_{\text{facility},y} \times EF_{\text{grid},CM,y}$$

Where

ER_y = emission reductions achieved in the year y;

$EG_{\text{facility},y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year y;

$EF_{\text{grid},CM,y}$ = combined margin emission factor;

>> The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{\text{grid},BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

$EF_{\text{grid},OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)

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

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

Below are the values of Build margin and Operating margin and the final combined margin:

EF _{grid,OM-adj,y} = Simple adjusted operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)		
EF _{grid,OM-adj,y} 2008	EF _{grid,OM-adj,y} 2009	EF _{grid,OM-adj,y} 2010
0.629	0.762	0.517
Weighted average		
0.634		

EF _{grid, BM, 2010}
0.175

EF _{grid,CM,y}
0.519



In order to estimate the ex-ante emission reductions for the first crediting period, estimated figures were used for parameters that are unavailable during validation or that are monitored during the crediting period.

$$EG_{\text{facility},y} = 176,700 \text{ MWh}$$

$$EF_{\text{grid},\text{OM-adj}, 2008,2009,2010} = 0.634 \text{ tCO}_2/\text{MWh} \text{ (detailed calculation in Annex 3)}$$

$$EF_{\text{grid},\text{BM},2010} = 0.175 \text{ tCO}_2/\text{MWh}$$

The default weights are as follows: $W_{\text{OM}} = 0.75$ and $W_{\text{BM}} = 0.25$, for the first crediting period.

Therefore, following the emission factor calculus:

$$EF_{\text{grid}, \text{CM},2008,2009,2010} = 0.75 * 0.634 + 0.25 * 0.175 = 0.519 \text{ tCO}_2/\text{MWh}$$

Therefore, for the first crediting period, the emission reductions are estimated for a year y , as follows:

$$ER_y = 176,700 * 0.519 = 91,705 \text{ (in tCO}_2\text{e)}$$

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

Year	Estimation of project activity emissions (tonnes of CO ₂ e)	Estimation of baseline emissions (tonnes of CO ₂ e)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of overall emission reductions (tonnes of CO ₂ e)
November 2013	0	15,284	0	15,284
2014	0	91,705	0	91,705
2015	0	91,705	0	91,705
2016	0	91,705	0	91,705
2017	0	91,705	0	91,705
2018	0	91,705	0	91,705
2019	0	91,705	0	91,705
October 2020	0	76,421	0	76,421
Total (tonnes of CO ₂ e)	0	641,936	0	641,936

Table 16: Estimation of Emissions Reductions.

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:	The following parameters shall be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid; and (ii) The quantity of electricity delivered to the project plant/unit from the grid
Source of data to be used:	The electricity will be measured through a bidirectional main meter and a bidirectional backup meter owned by UTE. They are located at the connection position UTE within walking distance to the substation project. The measurements will be cross checked with records of sold for electricity (see figure in annex 4). Additionally there will be a record of the energy generated by a SCADA.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	176,700
Description of measurement methods and procedures to be applied:	The quantity of electricity supplied by the project plant/unit to the grid and from the grid will be measured. Directly measured during the crediting period by SCADA system and records of sold of UTE. This data will be archived electronically as per internal procedures, for 2 years after the end of the last crediting period or the last issuance of credits, whichever occurs later.
Monitoring frequency:	Continuous measurement and at least monthly recording.
QA/QC procedures to be applied:	Data measured by UTE-meters will be cross-checked with the records from the electronic supervisory system of the wind farm and records for sold of electricity.
Any comment:	This data will be used to calculate direct emission reductions. Records of sales to the grid and other records are used to ensure consistency.

**B.7.2. Description of the monitoring plan:**

Monitoring tasks will be implemented according to the monitoring plan in order to ensure that the real, measurable and long-term greenhouse gas (GHG) emission reduction for the proposed project is monitored and reported.

The applicable methodology, ACM0002 is suitable for monitoring the emission reductions due to the project activity, according to the applicability criteria.

- A monitoring plan will be implemented to guarantee the accurate and transparent determination of avoided emissions. In accordance with the methodology, monitoring consists of metering the electricity generated by the renewable technology.
- All data collected as part of monitoring will be archived electronically and will be kept at least for 2 years after the end of the last crediting period or the last issuance of credits, whichever occurs later.
- All measurements will be conducted with calibrated measurement equipment according to relevant industry standards Commercial Measurements System by URSEA (URSEA Decision No. 14002 of 27 November 2002)²¹.

The park will feature a "Supervisory Control and Data Acquisition" (SCADA)²². This computer-based system that lets you monitor and control the park away, providing communication with field devices (standalone controllers) and controlling the process of automatically by specialized software.

This system will control all the aspects of the wind farm:

- Monitor and Control wind farm devices, including wind turbines;
- Advanced reporting options such as Report;
- Generator and Information Manager for downtime categorization;
- Remote alarm and event management via an intelligent event manager;
- A sharp, clear view of trends through the Gamesa;
- Trend Viewer;
- Power manager solution for grid code requirements: active, reactive and apparent power management,
- Adaptation to site using environmental options, including Gamesa NRS®, shadow control, wak cancellation control and ice detection system;

²¹ <http://www.ursea.gub.uy/inicio>

²² <http://www.gamesacorp.com/recursos/doc/productos-servicios/operacion-y-mantenimiento/ingles/gamesa-windnet-english.pdf>



- Wind farm device integration, including meteorological mast, substation and reactive compensation devices (STATCOM and SVCs);
- Status and alarm messages via SMS and e-mail;
- Remote Web client with a friendly, intuitive user interface;and,
- Includes Gamesa SMP, the CMS solution by Gamesa.

Monitoring Management Structure

In order to ensure that the project is well organized in terms of reliable data collection and gathering during the full crediting period, the organization of the monitoring team will be established and clear roles and responsibilities will be assigned to all staff involved in the CDM project. (General structure is showed in the Annex 4 of this PDD)

The project owner will train the relevant personnel before the project operation. The training will be commensurate with the work being done, as reflected in Annex 4.

The General Manager will hold the overall responsibility for the monitoring process, but as indicated below parts of the process are delegated. The first step is the measurement of the electrical energy supplied to abd from the grid and reporting of daily operations, which will be carried out by the plant operation staff.

The project owner will appoint a monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, collection of billing receipts of the power supplied by the grid to the wind farm and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, review the daily operation of the wind farm station including operating periods, power delivered to the grid, equipment defects, etc. Finally, the monitoring reports will be reviewed by the General Manager.

In summary, the monitoring plan of the project will be executed by the project owner, under the supervision of the CDM project consultant. The process will be carried out in accordance with the requirements of the applicable methodology and the EB on monitoring and verification to ensure that the emission reductions are monitored, recorded and reported accurately.

Monitoring equipment and installation

Given that the emission factor is calculated ex-ante, and referring to the Monitoring Methodology ACM0002, the only data to be monitored is the quantity of net electricity supplied to the grid by the wind project in every year.

The electricity generated will be measured both by the project sponsor through the "Supervisory Control and Data Acquisition". Two electricity meters will be installed by UTE: the main meter and a backup meter, as shown in the connection diagram below. Both will be bidirectional.

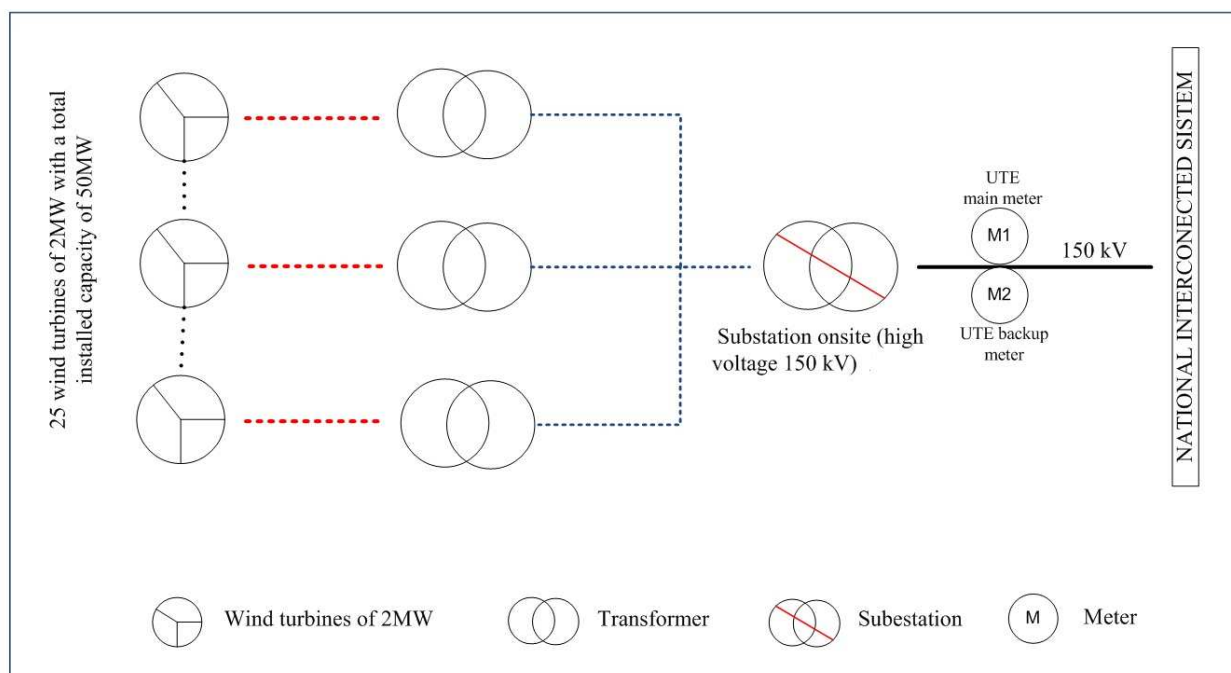


Figure 6: Grid connection diagram

Electricity meters will be of accuracy class of at least 0.5 S.

The grid connection diagram indicates the principles for positioning of metering instruments that will be used in the monitoring of emission reductions, and is showed in Annex 4 of this PDD.

The equipment used to monitor the electricity production will be provided by certified entities by UTE and calibration will be conducted according to the national requirements.

The regulatory body (URSEA) established regulations for the Measurement System Commercial, SMEC²³. This is applied to systems measurement for all commercial transactions between market players in the injection or withdrawal nodes of energy of UTE. It also establishes the requirements that have the facilities to measure energy, enabling conditions and penalties.

The SMEC is managed by the Electricity Market Management (ADME).

Calibration is performed according to the standard IEC 62053-22²⁴ for static active meters.

²³ Is managed by the Electricity Market Management (ADME).

²⁴ [Norma IEC 62053-22 \(2003\): Static meters for active energy.](#)

**Data recording and archiving**

A. Electricity supplied by the project to the grid will be monitored using a calibrated electricity meter. A main and a backup meter will be installed for metering the electricity supplied to the grid. Monthly records will be taken.

On the other hand UTE will install electronic meters that will measure the data in a continuous way. Data will be recorded at UTE's Distribution Management Centre (Centro de Mando de Distribucion). Project owner will have access to the Distribution Management Centre through a key provided by UTE.

B. Measurements will be cross checked with sale receipts for electricity and/or with the information published in the official web site of the operation coordinator of the National Interconnected System. Conservative values will be used for calculation of emission reductions.

C. The project participants will archive all data collected as part of monitoring during the monitoring period plus two years.

D. Quality assurance and Quality control will be applied:

- The quality of data generated by this project will be maintained through the development of an overarching monitoring system. This system may include procedures used to double check data, for staff training, meter calibration, accreditation of the facility completing calibration and the adherence to the relevant standards. All metering equipment to be used for the monitoring will be appropriately maintained, calibrated, and checked at regular intervals in line with the requirements of IEC 62053-22:2003 (Electricity metering equipment (a.c.) – Particular requirements – Part 11: Electromechanical meters for active energy (classes 0,5, 1 and 2)). All the equipment will be periodically calibrated by the public company in charge of the SMEC, Electricity Market Management (ADME).

E. Procedures on how to deal with erroneous measurements

Windnet control system (SCADA) will be interconnected to all those involved in real time (UTE, Gamesa control service, the project owner's control) that enable the identification of potential emergencies real time and can act accordingly.

Data measured by UTE-meters will be cross-checked with the records from the electronic supervisory system of the wind farm and records of sold electricity. Apart from this, consistency is guaranteed by cross checking the main and the backup meter readings with the invoice records for sold electricity. In case of inconsistency, the main meter readings, which is managed by the grid company (UTE), will be used for emission reductions calculation. Conservative values between both readings will be considered for emission reduction calculation.



Verification and Monitoring Results

The monitoring report will be prepared by the monitoring personnel. It shall contain the data report, and the results of the emissions reductions of the project for the defined verification period.

More details about monitoring plan can be consulted in the Annex 4.

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 the baseline study: 17/11/2011

Name of the responsible entity: **Zero Emissions Technologies S.A.**

Contact person (1): Alvaro Navarro Callejo

Email (1): alvaro.navarro@zeroemissions.abengoa.com

Contact person (2): Elena Fernández Ibáñez

Email (2): elena.fernandez@zeroemissions.abengoa.com

**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:**

11/03/2011 (UTE award resolution N° 11-307). In the context of the project this is the earliest date at which the real action of the project activity begun. With this award Palmatir S.A. begun the real activity to carry out the project.

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

The project activity is expected to have a lifetime of 20 (based Power Purchase Agreement with UTE) years from its commissioning date.

C.2. Choice of the crediting period and related information:**C.2.1. Renewable crediting period:**

Renewable crediting period. Two times.

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

01/11/2013, or the registration of the project, whichever is later.

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

N/A

C.2.2.2. Length:

N/A

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

Palmatir S.A. carried out a study on the environmental impact assessment (EIA) whose reference number is 2010/14000/05887. This document shows the physical, social, biological and cultural impacts in the zone where the project will be carried out.

Background

In compliance with the Decreto 349/05 art.5, on July 2, 2010 the project was classified as Category "B",

[...] “projects and activities, construction or works whose implementation may have significant environmental impacts moderate whose adverse effects can be eliminated or minimized through the adoption of measures well known and easily applicable “[..].

On April 4, 2011 was presented against DINAMA (Dirección Nacional de Medio Ambiente) the Environmental Impact Assessment.

Summary of impacts of the project were identified on EIA and mitigation measures suggested.

Impact Identification	Conclusion and Measures Taken
Physical presence of wind turbines	
Possible impacts caused by the physical presence of the turbines are: modification of the landscape, nuisance to local people by shadows, inconvenience to the local population by flashes ("Disc-Effect"), changes in land use and condition to local air activity.	Both the visual condition and the condition for leftovers will have small importance because in the first case, the road users will be some time in the vicinity of the project and the second values are not exceeded legal time shadows. On the other hand there will be no land use changes since the project is fully supported. The project is not located in any air route traffic so that the marking of the turbines will be sufficient as a security measure.
Construction and Civil Works	
During the construction phase have identified two impacts, solid waste generation, generation of emissions and waste of liquid.	To minimize the risks associated to the construction phase the Environmental Management Plan will include measures to reduce noise and dust and waste generation.
Construction of Roads	
In this case it is necessary to control three possible impacts, runoff modification, waste generation and emission of dust.	Due to the low slope of the land and the existence of some roads, significant changes in runoff are not foreseen; on the other side, measures include minimization and waste management will be included in the Environmental Management Plan.



Network Routing	
Temporary stockpiling of material from the excavation and waste cables.	No special mitigation measures were set, because of the low significance of the impact and because the waste management will be included in the Environmental Management Plan.
Noise emissions	
The impact identified is the condition to the neighbors for the increased noise level	The noise limits established by the Brazilian (CETESB L11.032) standard for rural areas sets a maximum value of 40 dB. According to the study these values are not exceeded in any of the nearby homes. In the Environmental License is included the necessity of noise control to avoid negatives effects. The brasilian standar has been utilized due to the lack of a national standard and because the Brazilian standard is more restrictive than the local "Ordenanza de ruido de Tacuarembó."
Impact on Birds and Mammals flying	
The potential impact is mortality or injury to birds and flying mammals	To minimize the risks of nesting in the project area dead trees and brush will be removed. In addition the EIA recommended the establishment of a monitoring plan for birds and mammals killed or damaged by the turbines
Social perception	
The social perception of renewable generation projects has increased energy positively in recent years.	No special mitigation measures identified.
Contingencies	
Possible contingencies in these types of developments are possible rupture or fall of a wind turbine and soil contamination due to accidental oil spill.	To minimize the risks will be a preventative maintenance of the wind turbines. Areas will be established for the storage of oils and their management will be hired Medinat authorized agents.

Table 1 : EIA Conclusions

The Previous Environmental Authorisation (Autorización Ambiental Previa, AAP) that is accompanied by the EIA was approved on 18 June 2012.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

No negative environmental impacts have been identified.

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

The Designated National Authority of Uruguay (Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente) requires that if the project is over 50 km of Montevideo (Uruguay's capital) to conduct two stakeholders meetings, one in the capital and the other in the project area.

The promoter of the project held two stakeholders meetings, the one in the Capital, Montevideo on the 14th November 2011 at La Cumparsita 1473, Rambla Sur, Montevideo, and the second one in Peralta, the nearest town to the project on 16th November 2011 at Escuela N° 67, Ruta 5 km. 290, Peralta, Tacuarembó, Uruguay.

Presentation in PTT format was sent 15 days before the event to the Uruguayan UCC and published in the web site.

300 invitations were sent by e-mail and 80 by courier 15 days before the event to local authorities, national authorities, entrepreneurs and academics representatives. The stakeholders were from UTE, ADME, ANII, MEF, IADB, CIU, MIEM, SNAP, MINTUR, DINAMA, MVOTMA, ANONG, among others. The main involved government sector were from MIEM (Ministry of Industry, Energy and Mining), MINTUR (Ministry of Tourism and Sports), MEF (Ministry of Economy and Finance), ANII (National Agency of innovation and investigation) and MVOTMA (Ministry of Housing, Land Management and Environment).

The event was also forecasted by radio and press and announcements in paper were located in local commerce and schools.

Local and national authorities, local residents and entrepreneurs attended to the event.

Both meetings began with the distribution of a summary document of the project that included a brief description of the CDM and requirements established by the DNA for these meetings. Subsequently, a presentation of the CDM project was conducted. This presentation was previously submitted to the Climate Change Unit (DNA) for their information.

The presentation ended with a space for public questions and opinions were collected and submitted to the DNA for the application for national approval letter.

E.2. Summary of the comments received:

No objections to the project were recorded.

Within the public's concerns and the points raised are:

- Questions and concerns about the impact on employment generation for the project.
- Concerns about recruitment and training local staff workshop in the catchment area of the park.
- Consultations on the location of sites and the location of the mills.



All the questions were explained and solved and no objections to the project were recorded.

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

All comments and questions received were answered during the events. There were no questions left out and all participants showed themselves satisfied with the answers given.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Palmatir S.A.
Street/P.O.Box:	Avda Uruguay, 1283.
Building:	
City:	Montevideo
State/Region:	Uruguay
Postcode/ZIP:	CP: 11.100
Country:	Uruguay
Telephone:	+59829022120
FAX:	
E-Mail:	
URL:	http://www.teyma.com/
Represented by:	Gustavo Amor Comesaña
Title:	General Manager
Salutation:	
Last name:	Amor Comesaña
Middle name:	
First name:	Gustavo
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Mobile:	+59894664182
Direct FAX:	+59829020919
Direct tel:	+59894664182 ext: 5108
Personal e-mail:	gamor@teyma.com.uy



Annex 2

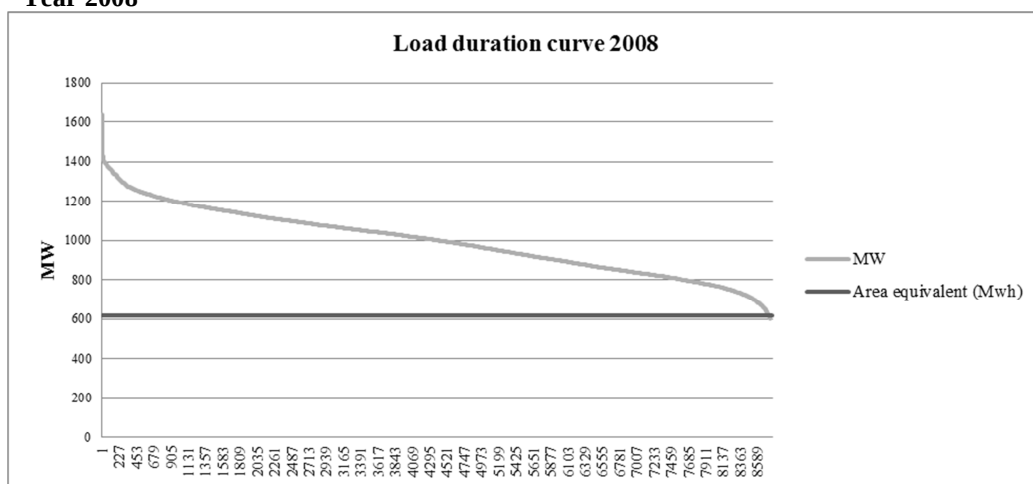
INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

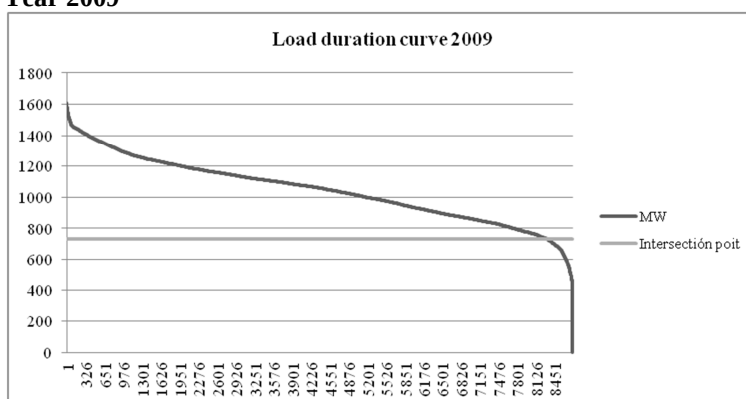
Below the graphics of λ_y (Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y)

Year 2008

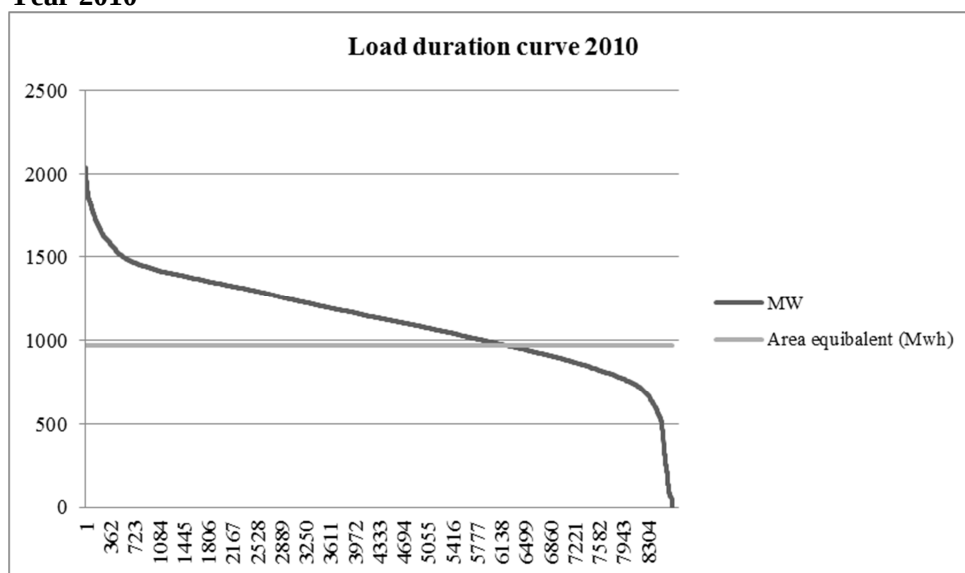


Estimate hours low-cost / must run on the margin	λ_{2008}
8760	0,0031

Year 2009



Estimate hours low-cost / must run on the margin	λ_{2009}
8760	0,0509

**Year 2010**

Estimate hours low-cost / must run on the margin	λ_{2010}
8222	0,2788

Annex 4**MONITORING INFORMATION****Management structure in order to monitor emission reductions**

The monitoring of the emission reductions will be carried out according to the scheme shown in Figure above.

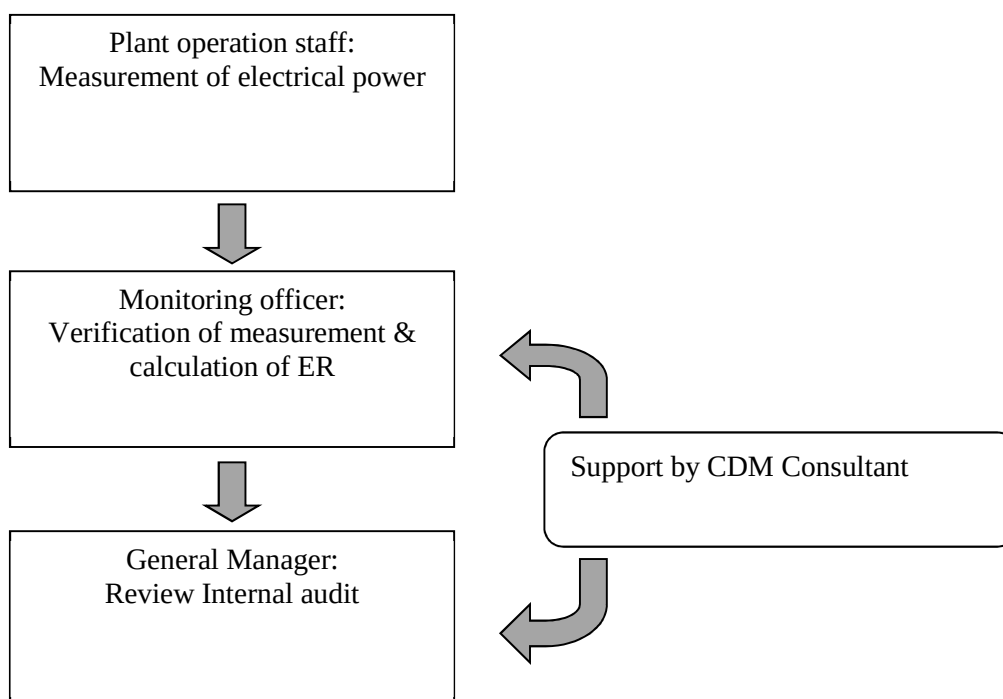


Figure 7: Management structure for monitoring

Provision for personnel training needs**a) Planned training:**

Planned training activities according to different positions:

- **Operating Personnel:**

The training will be implemented during the year and aims to cover 2 large areas of the formation. Related to the knowledge of the risks associated tasks, provided through induction courses and the related with the awareness of staff in Health and Safety issues, provided lectures broadcast by accident.

Also be complemented by training in the most significant risks: Working at Heights, Operation and Management Tools Load Manual.

The dissemination of emergency plans for all staff and training in PPAA of the Emergency Team members provide the knowledge necessary for an adequate response to incidents that may occur in the works.



On the other hand will run:

- Central Office Staff:
 - Emergency crew's certification according to firefighters.
 - Evacuation Plan
 - 2 fire drills
 - CPR training in general and in particular the emergency squad.
 - Controls and higher education:
 - Training and updating knowledge regarding application legal regulations, awareness and accident prevention course or first aid recycling.
- Staff for Logistics and Equipment:
 - Training of emergency brigades under emergency plan.
 - Training regarding emergency action and CP
- Equipment Operators:
 - Training on legal regulations, safe driving and handling equipment for defensive drivers.
 - In particular crane operators must receive ongoing Safe operation of cranes.
 - Technical Safety: training on standards implementation UNIT 18001-2007.
 - Personal leading light vehicles: defensive driving course.

b) Unplanned training:

Whereas the construction sites are very dynamic and issues arising during implementation where necessarily be required to provide worker training on specific risks, is expected to be provided during a series of unplanned training and in order to meet specific needs (list not exhaustive):

- Works in confined spaces
- Working at height
- Hot work
- Operation of cranes
- Work in excavations

- Biological hazards
- Lock energies

A diagram shows how parameters are monitored is presented as follows:

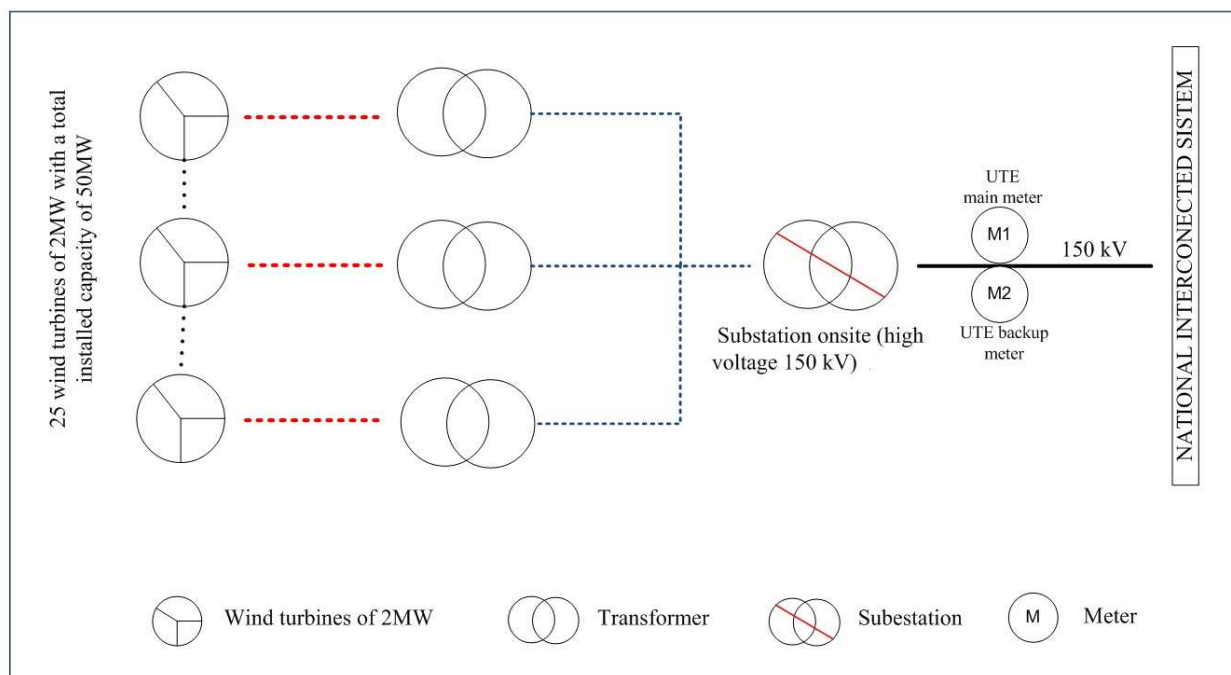


Figure 8: Grid connection diagram

The metering equipment are calibrated and checked for accuracy so that the metering equipment shall have sufficient accuracy within the agreed limits. The records will be supplied to the wind farm operator, and maintained by the operator.

The monitored data required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later.

If any error is detected, the party owning the meter shall repair recalibrate or replace the meter giving the other party sufficient notice to allow a representative to attend during any corrective activity.