



**Project design document form for
CDM project activities
(Version 06.0)**

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Amayo 40 MW Wind Power Project - Nicaragua
Version number of the PDD	Version 6
Completion date of the PDD	29/09/2015
Project participant(s)	1. Consorcio Eólico Amayo S.A. (Private entity) 2. Shell Trading International Limited
Host Party	Nicaragua
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral scope 1: Energy Industries – Renewable Applied methodology: ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 16)
Estimated amount of annual average GHG emission reductions	106,335 tCO ₂ /yr

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The main objective of the Amayo Wind Power Project¹ is to provide affordable electricity to the Nicaraguan grid using a clean and renewable energy source: the wind². For this purpose, the project makes use of nineteen 2.1 megawatt Suzlon S88 60HZ wind turbine generators, for a total power capacity of 39.9 MW per year. The net power production provided to the national grid is expected to be approximately 169 GWh per year. The project activity involves every stage, from the development, design, engineering and financing, to the construction, operation and maintenance of the Amayo's power plant facilities.

The baseline scenario –that is, the scenario that reasonably represents the anthropogenic emissions of greenhouse gases (GHG) that would occur in the absence of the proposed project activity- is the same as the scenario existing prior to the start of implementation of the project activity. This scenario consists mainly in the unaltered operation of the National Electric Grid.

Nicaragua's grid (namely, National Interconnected System, "NIS") consists mainly of thermal power plants. In 2007, 63% of the grid's effective capacity depended directly on the combustion of either fuel oil or diesel. Moreover, 74% of the NIS generation was provided by thermal plants in the same year. In contrast, the shares for renewable energy were significantly smaller: only 11% for hydro, 7% for geothermal and 8% for cane bagasse³. In 2014, the NIS has an estimated emission factor of 0.6273 tCO₂e per megawatt hour, which implies that the project will be able to displace 106,335 tCO₂eq per year for a total of 774,345 tCO₂eq in the chosen crediting period. In turn, this will occur since the availability of a cheaper (and cleaner) source will allow the NIS to reduce the amount of generation required from more expensive fossil fuel plants. The reduction of generation from one type of source (thermal plants burning fuel oil or diesel) in favor of generation from a renewable source (the Amayo Wind Farm) will reduce CO₂ emissions to the atmosphere arising from the former.

"Consorcio Eólico Amayo, S.A" ("Amayo" or "CEA"), a special purpose Panamanian corporation operating in Nicaragua through a Nicaraguan branch has been established by Arctas Capital Group LP ("Arctas"), Centrans Energy Services, Inc ("Centrans") and ENISA (the "Owner Group") to collectively develop the project. On the first quarter of 2014, Arctas assets were purchased by IC Power through its subsidiary Inkia Energy, Ltd ("IC Power"). CEA has signed two fifteen year power purchase agreements (hereafter, "PPA") with the two primary distribution companies of Nicaragua, Dissur and Disnorte, both wholly owned subsidiaries of TSK and Melfosur Internacional. .

After reviewing several competitors for the construction of the facility, CEA selected Socoin, a company highly experienced in the construction of wind projects, to provide a turnkey price for the site civil works and the balance of plant including the substation. In addition, Suzlon -the supplier of the wind turbines and ancillary systems- was contracted to provide a 5 year operations and maintenance service plan and warranty. An operating and maintenance building will be erected on the Project Site and will be used to manage the plant, to store critical spare parts and tools as well as the supervisory control and data acquisition system ("SCADA").

¹ It is confirmed, that the proposed CDM project activity is not a CPA that has been excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs

² The Amayo Wind Power Project falls into scope number 1. Sectoral Scope: Energy Industries-Renewable Sources

³ Source: INE. Figures as per original PDD.

The project is connected to the NIS using a substation built for this specific purpose. The latter was the subject of a detailed study by the firm Recursos Hidrolicos which concluded that the project can be interconnected to the grid with minimal system upgrades.

Contribution to sustainable development:

The Amayo wind farm produces significant benefits to Nicaragua. These include as per de original PDD:

- Increase in power supply in a country with energy deficit: The Amayo wind project will have an installed capacity of 39.9 megawatts, which will increase the supply of electricity and will reduce the rolling blackouts in Nicaragua⁴. This will improve living conditions of households and reduce business interruptions, therefore stimulating population income, employment and enhancing tax receipts of the Nicaraguan government.
- Reduction in electricity costs: The project will produce significant savings in respect to electricity costs offering one of the cheapest sources of energy in the country. The average power plant in Nicaragua utilizing fuel oil currently costs⁵ the Nicaraguan people approximately \$184 per megawatt hour, while the Amayo wind farm will have an initial cost to the Nicaraguan people \$86.25 per megawatt hour⁶ for a savings of nearly \$100 per megawatt hour. This will help make Nicaraguan industry more competitive and make electricity more affordable to the Nicaraguan people.
- Reduction of oil imports: The use of indigenous renewable energy sources will help reduce Nicaraguan consumption of imported fuel oil by 276,500 barrels per year⁷, thereby reducing currency expenditures of fuel purchases of approximately \$31.9 million per year⁸. This will enhance Nicaragua's balance of trade and strengthen the country's currency.
- Displacement of old carbon-intensive technology: The Amayo wind project will reduce the Nicaragua's reliance on expensive deteriorated fossil fuel fired power plants that are unreliable and significantly more expensive to operate.
- Employment generation: During the construction of the project, Socoin, the contractor installing the civil and electrical works, will be employing approximately 90 to 125 Nicaraguans. Suzlon, the supplier of the wind turbines will also employ 20 Nicaraguans during the installation of the components of the wind turbines. Once the plant becomes operational, the Amayo wind farm will employ approximately 18 permanent operational personnel, thus providing working opportunities for locals in an economically depressed area. In addition, the project is expected to create 60 indirect jobs in the local area.

⁴ These have been experienced frequently in recent years.

⁵ The average price presented is the spot market price (April 2008). Source: <http://www.cndc.org.ni>. These figures are as per original PDD, presented here for illustrational purposes only.

⁶ As stated in clause of the PPA.

⁷ According to data presented on Section B and Annex I of the original PDD (PDD version 3), in 2006 the Nicaraguan grid consumed 136,273.13 thousand gals of fuel oil, i.e. 3,244,598 barrels. Considering that this fuel allowed the generation of 1,988,996 MWh, it can be said that the NIS requires 1.6313 barrels of fuel oil in order to generate 1 MWh. Considering the project's expected generation (169,512 MWh), and assuming that the latter will displace fuel oil generation completely, it can be said that the project can reduce imports up to 276,524 barrels per year. It is important to remark, however, that these estimations are for illustrational purposes only.

⁸ @ 115.46 USD/barrel of fuel oil (price source: Energy Information Association average for July 2008 – estimate as per original PDD).

- Technology transfer: Amayo is the first project to employ this kind of resource in Nicaragua, which results in an important technology transfer to local workers. Suzlon will train the staff who will manage the operations of the facility and assist in the performance of warranty work as needed. This will create a pool of people in the country with operating experience in wind power generation.
- GHG emissions reduction: The Amayo wind power project is in line with the goals of Nicaragua's "Plan of National Action against Climate Change" (in Spanish, "*Plan de Acción Nacional para enfrentar al Cambio Climático*"⁹). This is because the proposed project activity will be generating electricity from a clean source, displacing generation from carbon-intensive technologies in the grid.

A.2. Location of project activity

A.2.1. Host Party

Nicaragua

A.2.2. Region/State/Province etc.

Rivas

A.2.3. City/Town/Community etc.

Rivas

A.2.4. Physical/Geographical location

The Amayo site is located 129 Km to the south of the capital city, Managua, on the Pan-American Highway near Rivas. The site is located on the south west coast of Lake Nicaragua. The area for the implementation of the wind farm is centered at the geographical coordinates 11°19'32" N and 85°43'05" W (datum NAD83) and has a total area of 276.36 ha. Figure 1 provides detailed description of the project location.

⁹ This document is available upon request.

Figure 1 – Amayo wind farm location



A.3. Technologies and/or measures

The project is located within the Amayo ranch, property of the Barrios Johanning family for more than 150 years. Before the implementation of this project, no electricity generation -from any source- was taking place at the site.

The wind farm is located in the shore of Lake Nicaragua in a relatively plain terrain which altitude increases with the distance from the latter. Wind speed varies from 8.0 m/sec on the west side of the park to 8.7 m/sec on the eastern sector, next to the shore.

The baseline scenario consists of the electricity that would have otherwise been generated by the operation of the rest of the grid-connected power plants and by the addition of new generation sources, excluding the Amayo wind farm. As stated before, this baseline scenario is dominated mainly by thermal power plants that burn fossil fuels in order to operate, therefore producing CO₂ emissions to the atmosphere¹⁰.

¹⁰ See Section B for a detailed description of the Baseline Scenario.

The layout of the Amayo Wind Project location has the main elements of a wind farm: wind turbines, wind measuring stations, a control house and an electrical substation. The location also has clear access to the roads, transmission lines¹¹, and the shore of Lake Nicaragua.

For approximately seven years, wind measurements were taken¹² in two different points of the Amayo site, where the wind mill park will be located. This data was collected under a strict and professional methodology, using calibrated NRG Systems equipment. Periodically, the machines were backed up and then reinstalled so they could continue recording data. Each tower included an anemometer and a wind indicator at 40, 30 and 15 meters of height. The logger used was an NRG System model 9200 which was programmed to measure wind velocity as well as direction every two seconds from three different heights, and record the average every 10 minutes. This allowed to estimate that the annual wind average is 7.5 meters per second on the west side of the park (at a height of 40 meters), and 8.4 meters per second on the East side of the park (at a height of 40 meters), closer to the shoreline of the lake.

The Project consists of nineteen (19) 2.1 megawatt ("MW") Suzlon S88 60HZ wind turbine generators ("WTGs"), with the following operating data: cut-in wind speed 4 m/s, rated wind speed 14 m/s, cut-out wind speed 25 m/s, survival wind speed 60 m/s. Suzlon wind turbines are designed to withstand the toughest environmental conditions. The robust design of the wind turbine, with its uniform weight distribution, ensures high levels of safety, reliability and enhanced service life. Suzlon's Advanced Control System includes precisely calibrated sensors installed at each critical junction that closely monitors factors like temperature, wind speed, vibrations etc. The remote monitoring and control option enhances ease of operation. A high-quality corrosion protection system comprising several layers of epoxy coat protects the structure and increases its service life. Suzlon's weather resistant nacelle cover is made of plastic reinforced fiber and designed in such a way that the internal components are fully protected against various ambient conditions.

The developer of the WTGs is Suzlon Energy, a fully integrated wind power company that ranks amongst the top ten companies in the sector. Suzlon integrates consultancy, design, manufacturing, operation and maintenance services to provide customers with total wind power solutions.

Germanischer Lloyd WindEnergie, a renowned international independent engineering firm, has certified that the Suzlon S88 wind turbine has been assessed by Germanischer Lloyd concerning the system design, prototype testing, manufacturer's quality system and the implementation of the design requirements in production and erection. Germanischer Lloyd attested compliance concerning the design in respect to the following:

- Load Assumptions according to GL Type Class 2A, 80 meters Hub Height
- Safety System and Manuals
- Rotor Blade
- Machinery Components
- Tubular Steel Tower, Hub Height 80 meters
- Electrical Equipment 60 Hz
- Commissioning
- Nacelle Cover and Spinner

¹¹ Main transmission lines were already in place and only a 400m line was constructed to connect the substation to the existing 230Kv line.

¹² This study was performed by an independent consultant (Braselco, a Brazilian firm specialized in wind and solar energy). The "Braselco Wind Study Report on Amayo" is available upon request by the DOE.

The Suzlon S88 wind turbines were originally installed on wind farms in the United States in 2005. Since then, version two and version three of the Suzlon S88 have been released with improvements in each successive version. The version of the WTGs that will be installed on the project site is version 3, which is equipped with more efficient rotors blades.

The power curve used for the calculation of the annual production of energy corresponds with the power curve furnished by Suzlon and used by Braselco for the wind study for the project. This power curve is guaranteed by Suzlon and has been registered. A copy of this power curve can be found in the Braselco brochure which is available upon request.

The wind park of Amayo has a control center and a 230/kV outdoor substation. The control center will be of approximately 180 square meters and will consist of the following:

- The control room where the computer control center of the wind farm is housed.
- 13.8 kV (LV) cabinets, (one for each of the lines coming from each of the generators)
- A warehouse, where the critical spares and other material are located for the operation and maintenance of the wind farm.
- Restrooms and changing rooms for the use of the operation and maintenance personnel and visitors.
- A Meeting Room, for the wind farm personnel and for the reception of any institutional visits to the wind farm.

The outdoor electrical substation is 600 square meters of area and is annexed to the control building where all of the 230/ kV electrical equipment of the wind farm reside, which includes the following: power transformer, interrupters, disconnecting switch, auto valves and a high voltage transformer.

Additional project details:

- This project has an estimated operational lifetime of 30 years corresponding to approximately 1.5 years of construction period and 28.5 years of expected equipment operation.
- The net capacity factor is 48.50%, based on the results of the Brazelco wind study report. This results from a study conducted by an independent company, based on guaranteed and typical values for wind turbine availability, internal grid availability, output substation availability, blades degradation, and other applicable factors.
- The metering system used in this project consists of both internal meters as well as the meters located on the external substation. Details of the metering scheme are provided on section B.7.3.

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Nicaragua (Host)	Consorcio Eólico Amayo S.A. (Private)	No
United Kingdom of Great Britain and Northern Ireland	Shell Trading International Limited (Private)	No

Consortio Eólico Amayo S.A. (Amayo Wind Consortium – CEA) was created by the firms Arctas (45% owner), Centrans (CES, 45% owner) and ENISA (10% owner) to collectively develop the project. Today Amayo is owned by IC Power (61.35% owner), Centrans (33.65% owner) and ENISA (5% owner).

Centrans is a Guatemala based group with interests in shipping and electricity generating plants. Centrans is one of the earliest developers of private power in Central America and an active player in the power generation in the Central American region. Centrans owns a 50% interest in Empresa Energética de Corinto, Ltd. - EEC, a 70 MW thermal power plant in Nicaragua. IC Power is a fast-growing global power generation company, established in 2007 as a subsidiary of Israel Corporation Ltd. (TASE: ILCO). IC Power's global portfolio includes controlling participation in approximately 2,642 MW in several operating assets in Israel and ten selected countries in Latin American and the Caribbean.

ENISA is a Nicaraguan firm and the original developer of the project. Contact information on project participants is provided in Appendix 1.

A.5. Public funding of project activity

N/A

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

Approved baseline and monitoring methodology applied:

- **ACM0002:** *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"* (Version 07 used on PDD version 3; this revision for the 2nd crediting period uses Version 16 of the methodology)

The following tools were applied together with the methodology:

- *"Tool to calculate the emission factor for an electricity system"* (Version 01 used in PDD version 3; Version 04 of the tool used for this revision)
- *"Tool for the demonstration and assessment of additionality"* (Version 05 – original additionality assessment reproduced here)
- *"Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period"* (Version 03.0.1)".

B.2. Applicability of methodology and standardized baseline

The proposed project complies with all the eligibility conditions stated in the methodology:

- The project activity consists of the installation of a greenfield, wind power plant (paragraph 3.a and 4.a of the methodology). And it does not involve a capacity addition to (an) existing plant(s), nor retrofit, rehabilitation or replacement of an existing plant(s)/unit(s). Hence paragraph 4 (b) does not apply.
- Conditions stated on paragraphs 5-10 of the methodology do not apply to this project, as they refer to hydro power plants, fuel switching projects, biomass fired power plants/units or retrofits, rehabilitations, replacements or capacity additions in existing plants.

- The emission factor tool is applicable as: the project activity substitutes grid electricity (i.e. the project activity supplies electricity to a grid, paragraph 3 of the tool). Only grid-connected power plants are considered (paragraph 4 of the tool). The project electricity system is not located in an Annex I country (paragraph 5). No biofuels are involved (paragraph 6). The methodological tool “*Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period*” is applicable to every project seeking to renew its crediting period and has no further applicability conditions. Likewise, the “*Tool for the demonstration and assessment of additionality*” (version 05, as used on the original additionality assessment) does not include specific applicability conditions.
- The “*Tool to calculate the emission factor for an electricity system*” can be used to estimate grid emission factors for projects that substitute grid electricity (such as the Amayo project). The proposed project is not located in an Annex I country.

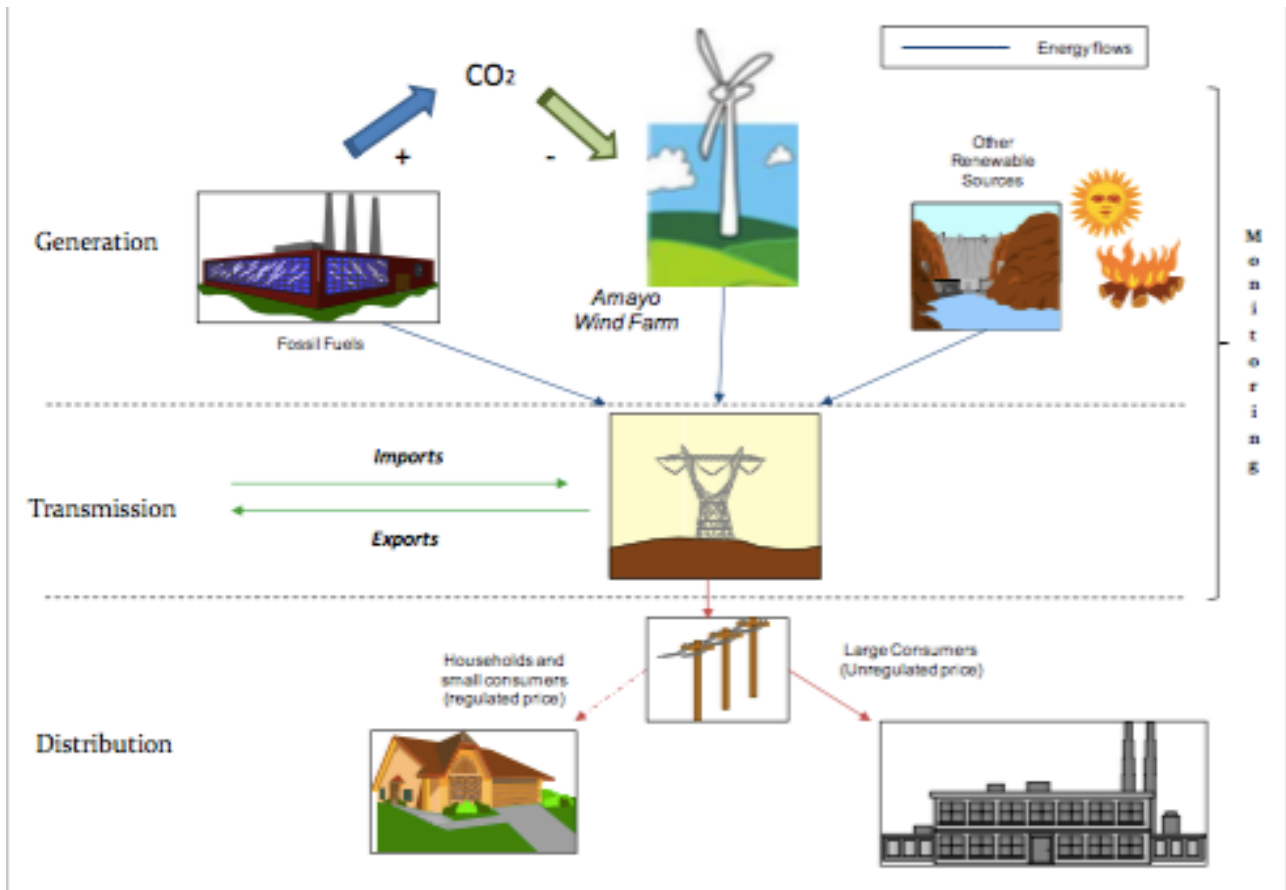
The geographic and system boundaries for the relevant electricity grid can be clearly identified, and information on the characteristics of the grid is available. The relevant grid is the National Interconnected System; the information required is available from the Nicaraguan Institute of Energy (“Instituto Nicaragüense de Energía”, INE). Historical data from the plants in the grid is available. INE is the official source for this information.

B.3. Project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Grid electricity generation	CO ₂	Yes	Main emission source
		CH ₄	No	Not considered
		N ₂ O	No	Not considered
Project scenario	Wind power generation	CO ₂	No	There are no CO ₂ emissions generated from wind power projects
		CH ₄	No	There are no CO ₂ emissions generated from wind power projects
		N ₂ O	No	There are no CO ₂ emissions generated from wind power projects

A diagram of the project boundary, the Nicaraguan National Interconnected System, is shown in Figure 2 below. As stated before, all relevant information on the main aspects of the grid is readily available by the INE.

Figure 2 - Project boundary



B.4. Establishment and description of baseline scenario

Paragraph 23 of the methodology unambiguously defines the baseline scenario applicable to this project:

“If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the ‘Tool to calculate the emission factor for an electricity system’” (ACM002 version 16, paragraph 23).

The validity of the baseline for the project’s second monitoring period is assessed by means of the methodological tool *“Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”* (version 03.0.1). The latter provides a stepwise procedure to assess the continued validity of the baseline.

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The relevant legislation applicable at the time of the registration has not suffered considerable changes¹³. Law 272 (which governs generation, distribution, pricing and transmission of energy in Nicaragua) and Law 532 (for the promotion of renewable energies) are still in force, and the project's compliance with this framework has not been modified. Carbon intensive technologies are still the predominant sources of electricity in Nicaragua.

As per the tool, the next relevant step is thus Step 1.2.

Step 1.2: Assess the impact of circumstances

In the situation where the baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is required for the renewal of the crediting period.

In Nicaragua, a number of renewable energy projects have entered the grid since the registration of the Amayo wind farm. However, most if not all of these efforts have been a consequence of policy instruments that were already available at the time of the project's registration, namely, the Clean Development Mechanism and the incentives provided in Law 532. According to the latest statistics from INE¹⁴ and UNFCCC, at the end of 2014 every wind farm in Nicaragua is a registered CDM project: Amayo II (CDM # 5305); Blue Power & Energy (CDM # 8221), Eolo de Nicaragua (CDM # 6143) and Camilo Ortega Saavedra (owned by ALBANISA, registered CPA #1, PoA #7274). The necessity of all these projects to pursue aid schemes such as the CDM shows that market characteristics are still similar to those at the time of the project registration, i.e. that wind farms are still perceived as a risky investment. Furthermore, the expansion in renewable energies' share in the generation mix is explained mostly by the addition of wind farms, which as explained before have been dependent on CDM incentives. No other fuels or raw materials have been introduced since the time of the project registration.

Even though there's been an addition of renewable energy generation plants, the common practice in Nicaragua is to generate electricity using fossil fuels. The average percentage of thermal electricity generation (fuel oil + diesel) during the period 2012-2014 is of 53.06% according to national data¹⁵.

Therefore, the baseline scenario remains the same as in the previous crediting period, namely, *"electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the 'Tool to calculate the emission factor for an electricity system'"* (ACM002 version 16, paragraph 23).

Step 1.3: Only applicable to baseline scenarios consisting of the continuation of the current equipment at an existing site. The baseline scenario during the validation of the project activity will require investment, therefore doesn't apply to this project.

Step 1.4: Assessment of the validity of the data and parameters

¹³ Regulatory framework available at: <http://www.ine.gob.ni/DGE/digestoJuridico.html>. Reforms to Law 272 introduced after the validation / registration of the Amayo project include: Law 839 (2013, which is mainly applicable to distributors), law 746 (2011, mainly regarding the role of the public company ENEL), law 728 (2010, mainly applicable to distributors) and law 682 (2009, which also refers mainly to distributors). None of these modifications represent significant changes in the regulatory framework governing wind farms.

¹⁴ File: *Capacidad_Instalada_2005-2014_actAbr15.pdf*. Available to the DOE

¹⁵ File: *Generacion_Neta_2005-2014_actAbr15.pdf*. Available to the DOE.

The tool states that emission factors, values or emission benchmarks that are used and determined only once for the crediting period should be updated. In this project, the relevant factor is the combined margin emission factor (CM), which according to the relevant tool has to be updated for a second crediting period (Tool to calculate the emission factor for an electricity system, Version 04.0, paragraphs 36, 68, 81). Therefore the current baseline must be updated.

The parameters that were updated are the following:

- Density of fuel i in year y (D_i)
- Thousand gals ($FC_{i,m,y}$).
- Net electricity generated and delivered to the grid by power plant/unit m in year y . ($E_{gm,y}$).
- Plant name.

Step 2: Update the current baseline and the data and parameters

Applicable as Step 1.4 above shows that the baseline needs to be updated.

Step 2.1: Update the current baseline

This step requires to apply the latest approved version of the methodology applicable to the project activity. For this project, the methodology shifts from version 7 to version 16. See details of the application of the new version of the methodology in sections B.2 and B.6.1.

Step 2.2: Update the data and parameters

All updated data and parameters are presented on section B.6.2. Description of relevant methodological choices is available on B.6.1 and the results of the ex-ante estimate for emission reductions is available on section B.6.3.

This concludes the application of the tool “*Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period*”

B.5. Demonstration of additionality

The original additionality demonstration for this project is reproduced below:

Box 2 - Project additionality demonstration as per original registered PDD (version 3)

To demonstrate that the proposed project activity is not a part of the above mentioned baseline scenario (i.e. to demonstrate that the project is additional), the “Tool for the demonstration and assessment of additionality” (version 05) was used.

The Amayo Wind Power Project is not a recent development. It was originally conceived with 20 MW of capacity, as shown in the first EIA studies undertaken in 1999¹⁶. However, this was never implemented since at that moment the project was unable to achieve a competitive price. In November of 2005, the project received a power supply bid invitation from distributors DISNORTE and DISSUR. The project was expanded to 40MW and considered CDM revenues in the

¹⁶ Document available upon request by the DOE. [Original footnote as per registered PDD]

formulation of its offer price.

In its original form, the bid invitation allowed for a maximum energy price of 0.065 US\$/kWh.¹⁷ However, the project was not able to sell power at this price, even after considering CDM revenue, since such a price would not allow the project to achieve its targeted investment return.¹⁸ This requirement was relaxed by the distributors in an addenda to the invitation to bid dated March 2006, allowing offers above the 0.065 US\$/kWh thresholds¹⁹.

On July, 2006 CEA, as represented by ENISA, submitted an offer of US\$0.0884/kWh and was awarded the bid. After CEA was awarded the bid by DISNORTE and DISSUR the parties commenced negotiations of the two Power Purchase Agreements ("PPA"), 20 MW for each utility. During the negotiations of the PPA, DISNORTE and DISSUR, agreed in section 8.1 of the PPA, to assume the responsibility to pay all transportation costs associated with the supply of the energy, in exchange for CEA's agreement to lower the bid price to US\$0.08625/kWh. The reduction in the original bid price relates solely to the agreement of the utilities to assume the transportation costs and has nothing to do with CDM revenues.

It is important to note that without considering CDM revenues the price of US\$0.08625/kWh would not have been sufficient to exceed the benchmark rate (minimum return) of 15.4%. This can be observed in the financial model by disabling CDM revenues (assign "0" to cell I42 in the "Annual Financial Summary" tab of Amayo PDD Model Version 1). Without CDM revenues CEA would have needed to bid a higher price.

During the PPA negotiations, CEA continued to investigate the viability of CDM revenues and met with several established advisors to determine the eligibility, applicability and value of the carbon credits. In August, 2006 representatives of CEA met with Japan Carbon Credit Finance to specifically discuss the commercialization of carbon credits.

On February 12, 2007, CEA signed the PPA's with DISNORTE and DISSUR.

On March 30, 2007 CEA signed the wind turbine supply agreement with Suzlon Wind Energy Portugal Ltda and Suzlon Wind Energy A/S whereby it committed to certain financial obligations relating to the purchase of the wind turbine generators and ancillary equipment.

On June 4, 2007 Banco Centroamericano de Integración Económica ("BCIE") approved a \$71.25 million loan fifteen year construction/term loan to CEA.

Following these dates CEA continued to take action to secure CDM incentives which were considered vital to the economic viability to the Project. On August 16, 2007 the board of directors of CEA met to authorize the management of CEA to sign the BCIE loan agreement and to enter into agreements to commercialize the carbon credits generated by the Project. Provided below is a brief excerpt of the minutes of that Board meeting:

*"The President (of the Board of Directors) indicated that the purpose of the meeting was (...) to authorize the officers to commercialize, and to locate a party to assist in the registration and commercialization of the carbon credits, **which are critical to the financial viability of the company's 40 MW wind project in Rivas (the 'Project')**. Upon motion duly proposed, seconded and unanimously approved, it was resolved (...), **given the importance of the Carbon Credits to the economic viability of the Project, to direct***

¹⁷ Page 9 of the bid invitation document states that "the bidding price for energy shall be lower or equal to six and a half cents of a Dollar for kilowatt-hour (0.065 US\$/kWh) for all the established term in this bidding. All biddings with higher prices will be rejected" (November 2005; this document is available upon request by the DOE) [Original footnote as per registered PDD]

¹⁸ This can be demonstrated by means of the Amayo financial model provided to the DOE. Assuming a 0.065 US\$/kWh price for energy (cell G29 on the assumptions sheet) leaves the project below the minimum return rate even after considering CDM and Nicaraguan fiscal incentives. See sub step 2.b of this section for a discussion on the minimum acceptable rate. [Original footnote as per registered PDD]

¹⁹ Union Fenosa Adenda 3 (Page 3, Part II). Available by the DOE. [Original footnote as per registered PDD]

and authorize the officers of Amayo to secure a contract with a reputable firm on behalf of Amayo to assist with the registration and commercialization of the Project's Carbon Credits.”²⁰

In September of 2007 entered into a contract with **Geoingeniería Ingenieros Consultores S.A.**, to be its advisor to support the Client in registering the Project as a CDM in the UNFCCC.

Additional evidence of actions taken to continue to secure CDM status for the project in parallel with its implementation is readily available to the DOE.

The additionality tool consists of a series of steps, as stated below:

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

This step presents realistic and credible alternatives to the project activity. These alternatives can be part of the baseline scenario described in Section B.4.

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

The output of the project activity consists of electricity that will be delivered to the Nicaraguan grid from a renewable, zero-emission source. The project was awarded the power purchase agreement after winning a renewable energy bid solicitation conducted by Union Fenosa affiliates, Dissur and Disnorte in the summer of July 2006. Valid alternative scenarios are mainly:

1. The proposed project activity undertaken without being registered as a CDM project activity;
2. Continuation of the current situation, i.e. no project activity undertaken. This would imply that electricity would be generated by the operation of the rest of the grid-connected power plants and new oil fired additions. This business-as-usual scenario is dominated mainly by thermal power plants that burn fossil fuels in order to operate, therefore producing CO₂ emissions to the atmosphere.

Sub-step 1b. Consistency with mandatory laws and regulations:

Regulatory framework relevant for the proposed project involves the following set of norms²¹:

- Ley No. 272 (1998): Ley de la Industria Eléctrica y Decreto No. 42 (1998): Reglamento a la Ley de la Industria Eléctrica (“Law of the Electricity Industry and its Regulatory decree”).
- Ley No. 532 (2005): Ley para la Promoción de Generación Eléctrica con Fuentes Renovables (“Law for the Promotion of Power Generation from Renewable Sources”).

The first alternative consists of the proposed project activity undertaken without the CDM. From the Republic of Nicaragua's regulations point of view, this is the same as the

²⁰ Extracted from the *Minutes of the Meeting of the Board of Directors of Consorcio Eólico Amayo, S.A* (held on August 16th, 2007, at 11 a.m in the City of Houston, Texas). These minutes are available upon request by the DOE. [Original footnote as per registered PDD]

²¹ Other regulations that are not specific for the alternatives listed were excluded for simplicity; these include Law No. 217 (“General Law for the Environment and Natural Resources”) Decree No. 45 (“Regulation for Environmental Impact Assessments and Permits”), among others. Needless to say, all the alternatives listed are in compliance with all these norms. [Original footnote as per registered PDD. At the time of renewal of the crediting period, these laws remain in force]

proposed project in its present CDM state, which has already proven compliance with all national regulations²². Specifically, it complies with Law 272, which governs generation, distribution, pricing and transmission of energy in Nicaragua; and it benefits from the incentives established in Law 532, which determines fiscal incentives for renewable energy generation, among which the wind is included²³. The second alternative consists of no project activity, i.e. the continuation of the business-as-usual scenario. It is assumed that all the existing facilities –as well as those to enter the grid in the future- are in compliance with all the regulations established in Law 272.

Step 2. Investment analysis

The purpose of this step is to show that the proposed project activity is economically and financially less attractive than at least one other alternative, identified in step 1, without the revenue from the sale of certified emission reductions (CERs). The analysis is in compliance with the *"Guidance on the Assessment of Investment Analysis"* (Version 02 – EB41).

Sub-step 2a. Determine appropriate analysis method

The project activity generates incomes other than CDM related income, so a straight forward cost analysis cannot be applied. Instead, benchmark analysis (Option III) will be used. As stated on the "Guidance on the Assessment of Investment Analysis" (version 2):

"If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used. If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate." (page 4).

In this case, the project participant is *not* forced to make an investment in the same or similar products or services. This would be the case, for example, of a public facility which aims at generating a given output independently of the source and technology used (hydro, thermal, etc).

The guidance further states that:

"The benchmark approach is therefore suited to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest." (page 4)

This is clearly the case for a private facility in general, and for CEA in particular. This justifies the choice of Option III: Benchmark analysis.

Sub-step 2b. Option III: Benchmark analysis

The Internal Rate of Return (IRR) is one of the most widely accepted financial indicators for project evaluation. As stated in the tool for the demonstration and assessment of additionality, and considering there is not just one potential developer for this type of project, the project IRR was used²⁴.

²² Since the proposed project has obtained all the required permits by national authorities. [Original footnote as per registered PDD]

²³ See Law 532, Page 2, where wind energy is classified among renewable sources and therefore within the generation sources eligible for incentives. [Original footnote as per registered PDD]

²⁴ Project IRRs calculate a return based on project cash flows only, irrespective the source of financing. [Original footnote as per registered PDD]

The most plausible benchmark to compare the project IRR has been derived from government bond rates (MHCP Bonds²⁵), presented below:

Table B.4 – Government Bond Rates

Maturity (years)	Amount (million dollars)	IRR (%)
3	1.04	11.53
3	0.5	11.23
3	0.3	11.33
3	0.27	11.28
Weighted average		11.40

Source: Nicaragua's Central Bank (www.bcn.gob.ni)

The bonds presented have the longest maturity possible for Nicaraguan bonds. Evidence of this can be found in the 2007 Public Debt Report: *"It is important to remark that the Ministry of Economy and Public Credit managed to sell bonds with three year maturity period"*²⁶ Considering a shorter maturity period for the benchmark is essentially a conservative assumption since, if the government of Nicaragua issued bonds with a longer maturity, holders would require either an equal or even a higher return, but unlikely a *lower one*. This implies that the average 11.40% rate used by the project participants is in fact a conservative benchmark rate; if longer instruments would have been considered, this rate value would have been higher.

The average rate is adjusted by a suitable risk premium to reflect the project type. This premium is usually no less than 4%²⁷. Therefore, the benchmark rate is 11.40% + 4% = 15.40%.

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

The project's cash flow analysis developed by Consorcio Eólico Amayo personnel is based on confidential information and its details have only been made available to the DOE²⁸.

The cash flow is based upon the following assumptions:

²⁵ In Spanish, "Bonos del Ministerio de Hacienda y Credito Público - MHCP". The presented rates correspond to the August-November 2007 auctions. The official, more detailed document from the auction is available upon request. [Original footnote as per registered PDD]

²⁶ Central Bank of Nicaragua - 2007 Public Debt Report, page 13 (a copy of this document in its original language is available upon request by the DOE) [Original footnote as per registered PDD]

²⁷ This 4% assumption is a very conservative one since (a) the project activity is much riskier than the alternative of purchasing government bonds and (b) the bonds have a three year maturity, while the Amayo Wind Farm encompasses a considerably larger period (over 28 years). For evidence on the conservativeness of the assumption, please refer to *"Estimating the Real Rate of Return on Stocks Over the Long Term (Presented to the US Social Security Advisory Board), August 2001"* (available to the DOE). Table 2 (p. 24) on this document states that the historical premium over bonds for the 52 years comprised between 1946-1998 has been 6.5%. When discussing future reasonable values for this premium, the authors state that *"Instead, one might choose an assumption that approximates the experience of the past 75 years- 2.2 percent, which suggests an equity premium of around 5.0 percent"* (p.24). Project participants have chosen an even smaller risk premium: 4%. [Original footnote as per registered PDD]

²⁸ The model presented to the DOE is the same version of the model used by the project participants to evaluate the financial and economical viability of the project. A simplified version was also made available to the DOE; however, both versions (full and summarised) lead to the exact same results. [Original footnote as per registered PDD]

- The Amayo Wind Power Project will provide an annual generation of 169,512.20 MWh
- Project life: 28.5 years (the turbine life certified by Gemaniche Lloyd).
- Terminal value of project: 0%
- According to Annex 3 of the 22nd Executive Board Report “*Clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios – Version 2*”, the baseline scenario should refer to a hypothetical situation without any national and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies. In the specific case of Nicaragua, the relevant law is the “Law for the Promotion of Power Generation from Renewable Sources” (Law Number 532)²⁹. Therefore, although only the hypothetical scenario with no fiscal incentives could be considered for additionality purposes, we present our calculations for both the hypothetical situation and the real one³⁰.
- CER price is assumed to be at 16 US\$/tCO₂ for the whole project period.

The IRR analysis outcome is presented in Table B.5 below:

Table B.5 – Benchmark Analysis Results

Without CDM Revenue	No Fiscal Incentives	11.72%
	With Fiscal Incentives	14.30%
With CDM Revenue	No Fiscal Incentives	13.53%
	With Fiscal Incentives	16.75%
Benchmark rate		15.40%

The investment analysis clearly shows that the proposed project's IRR falls below the benchmark rate in every case except when both fiscal incentives *and* CDM revenues are considered. This demonstrates that the Amayo Wind Power Project cannot be considered a financially attractive option without the additional revenue provided by the Clean Development Mechanism, i.e. that the project is additional to the baseline scenario.

Sub-step 2d. Sensitivity analysis

The following project variables were identified as uncertain factors and therefore eligible for a sensitivity analysis³¹:

- *Project output*: Wind projects are subject to unforeseen variability in wind flows – mostly, speed and direction-, which may affect the project's power generation.

²⁹ This is only true for regulations and policies that have been implemented since the adoption of the Kyoto Protocol by the host country. The government of Nicaragua ratified the Kyoto Protocol on November 1999, while the national law established to promote the diffusion of renewable energy (Law Number 532) in this country is dated May 2005. [Original footnote as per registered PDD]

³⁰ Law number 532 establishes fiscal incentives (namely, a seven year income tax holiday and reductions in municipal taxes). It also establishes exemptions on all import taxes and tariffs, but these are not relevant for the project since the kind of capital goods that will be imported during the investment phase have a 0% tax in Central America. [Original footnote as per registered PDD]

³¹ Electricity price is not considered a risky variable since it is clearly determined in the PPAs. [Original footnote as per registered PDD]

However, the winds flows on the site have been measured over a seven year period, which reduces the risk of unforeseen variability. In its wind study report for the project site, the independent firm Braselco concludes that “the favorable wind conditions observed in the region where the Amayo Wind Farm will be implemented made it clear that the wind presents characteristics similar to those of *trade winds* (macroscale) and *lake breezes* (mesoscale). The simplicity of these two mechanisms of wind formation ensures inter-annual regimes of considerable regularity”³². A $\pm 10\%$ variation is assumed for the project output as suggested by the Guidance on the Assessment of Investment Analysis (Version 02). It is important to stress, however, that this is a conservative assumption since, as described earlier, the wind flows have been measured over a long period and significant departures from this parameter’s expected value are not likely to occur³³.

- *Contingent costs*: A $\pm 10\%$ variation in contingent costs during the construction phase is a reasonable range for this variable.
- *O&M costs*: A $\pm 10\%$ margin is assumed for this variable during the risk analysis.

Tables B.6.a and B.6.b below present the results from the sensitivity analysis. The first table refers to the hypothetic scenario with no fiscal incentives; the second one leaves this assumption behind. Figures B.3.a and B.3.b illustrate.

Table B.6.a – Sensitivity evaluation results (No fiscal incentives scenario)

Risk Variable	No Fiscal Incentives		
	Good Scenario	Base Scenario	Bad Scenario
Project Generation ($\pm 10\%$)	13.11%	11.72%	10.29%
Contingent Costs ($\pm 10\%$)	11.79%	11.72%	11.66%
O&M Costs ($\pm 10\%$)	11.91%	11.72%	11.53%

Figure B.3.a – Sensitivity analysis results

³² Braselco Wind Report, page 36 [Original footnote as per registered PDD]

³³ Although wind flows may have strong volatility around their mean value, it is unlikely that this expected value (itself a random variable) has significant variation. This is because of *the size of the sample* upon which it was estimated (as stated earlier, the latter includes observations collected over a 7 years period). [Original footnote as per registered PDD]

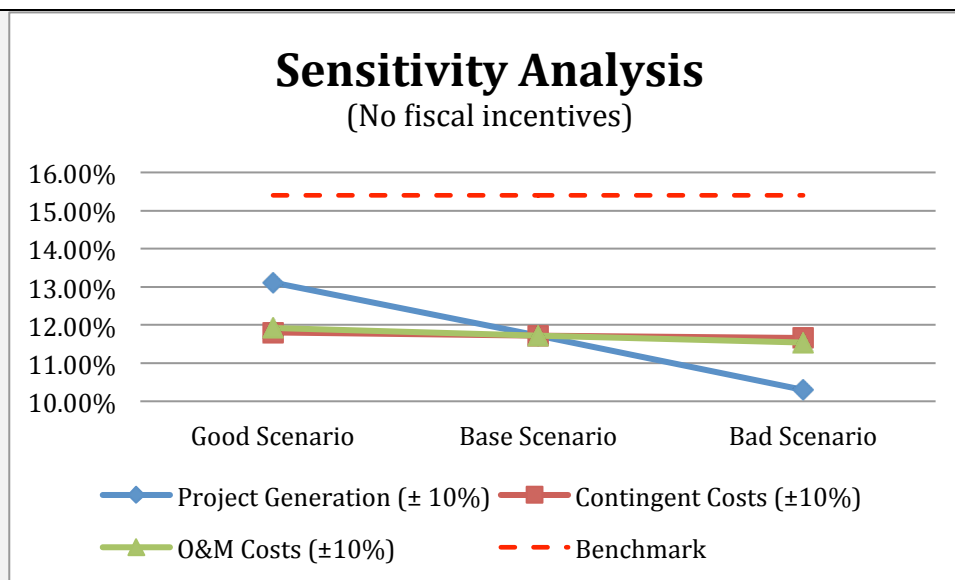
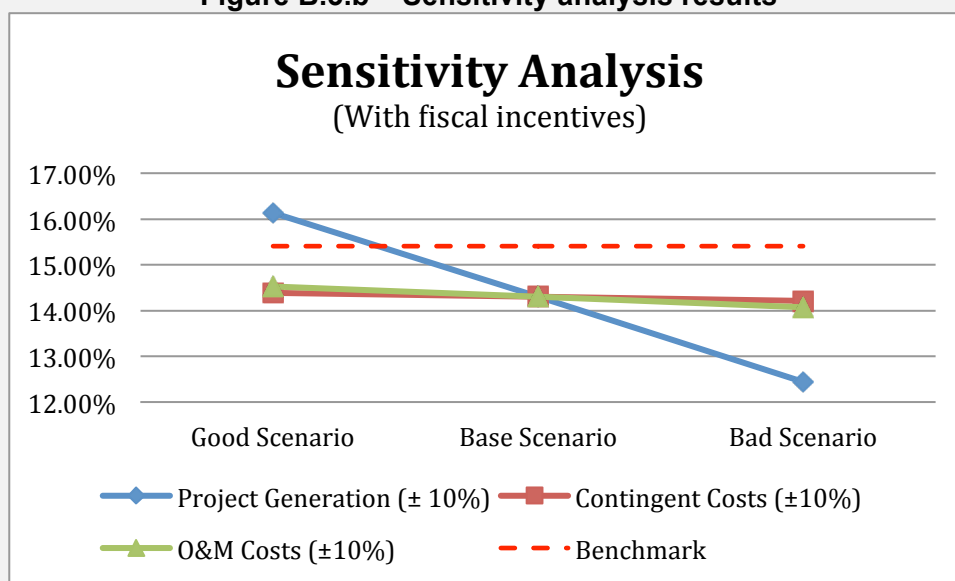


Table B.6.b – Sensitivity evaluation results (considering fiscal incentives)

Risk Variable	With Fiscal Incentives		
	Good Scenario	Base Scenario	Bad Scenario
Project Generation ($\pm 10\%$)	16.13%	14.30%	12.44%
Contingent Costs ($\pm 10\%$)	14.38%	14.30%	14.21%
O&M Costs ($\pm 10\%$)	14.52%	14.30%	14.07%

Figure B.3.b – Sensitivity analysis results



It is clear from the above figures that the benchmark IRR is still above the project's expected return, even after considering a reasonable range of variations in the critical assumptions. Only when considering a *permanent*, 10% raise in the project's expected output the estimated IRR is above the required return. However, this requires taking into

account *fiscal incentives*, which should be disregarded according to EB 22 (“*Clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios – Version 2*”). The return falls below the benchmark when fiscal incentives are not considered (see table B.6.a) In addition to this, it is important to recall that considering the extensive wind data upon which the project’s generation was estimated, a range as wide as +/- 10% is not likely to occur. Finally, notice that while a 10% increase in the project output puts the IRR above the benchmark by less than 1 percentage point, a 10% *decrease* would reduce the former by *almost 3 percentage points below* the latter. This reflects considerable risk under this hypothetical scenario. On every other case –even when considering fiscal incentives- the estimated IRR does *not* cover the minimum required return.

These results provide a valid argument in favour of the project’s additionality since they consistently support the conclusion that the project activity is unlikely to be financially attractive, unless CDM revenues are taken into account.

Step 4. Common practice analysis

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

In a broad sense, Nicaragua is still going through an early stage in the development of power generation from renewable sources in general and wind projects in particular. Recent studies³⁴ show that Nicaragua has an estimated wind-power potential of over 700MW which could eventually reach over 2000MW capacity if the corresponding transmission lines are duly expanded. However, the Amayo Wind Power Project is the very first wind farm in Nicaragua and therefore no similar activities are currently taking place in the country.

The most common renewable sources in the country are hydro, biomass and geothermal. Table B.7 shows all renewable sources in the country:

Table B.7 – Renewable sources in Nicaragua (year 2007)

Type of facility	Plant Name	Capacity (MW)	% over total grid	Private / Public ?	Comparable to project activity?
Thermal Plants (biomass)	Nicaragua Sugar Estate Ltd (NSEL)	59.3	7%	Private	Different scale
	Monte Rosa	67.5	8%	Private	CDM - Different scale
Hydroelectric Plants	El Bote	0.9	0%	Private	CDM - Different scale
	Centroamérica (HIDROGESA)	50	6%	Public	Different scale
	Santa Bárbara (HIDROGESA)	54.4	7%	Public	Different scale
Geothermal plants	Ormat Momotombo Power Company	77.5	9%	Private	Different scale
	Polaris Energy Nicaragua, SA (PENSA)	10	2%	Private	CDM

Source: <http://www.ine.gob.ni/estadisticasdge/capacidad%20instalada.pdf>

None of these plants are similar to the proposed project activity. Hydro technology plants are mainly public enterprises not comparable to the Amayo Wind Farm since the latter is a private undertaking and as such is subject to greater profitability requirements. Similarly,

³⁴ See for example “Nicaragua’s Wind Map Project” available at <http://www.encocentam.com/page.asp?DH=28> [Original footnote as per registered PDD]

the only geothermal plant and one of the biomass projects (Monte Rosa) have been registered as CDM projects³⁵. Lastly, the NSEL plant is also not comparable to the proposed project since the former is a sugar mill which does not depend solely on the revenues generated by its energy sales to the grid.

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

This section does not apply to the proposed project activity since -as argued in the previous sub-step- there are no similar activities occurring at the moment in Nicaragua. Thus, the additionality argument for the Amayo Wind Farm concludes it has satisfied all of the steps of the relevant methodological tool.

B.6. Emission reductions

B.6.1. Explanation of methodological choices³⁶

Emission reductions are calculated as follows:

$$(1) \quad ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year y (tCO ₂)
BE_y	=	Baseline emissions in year y (tCO ₂)
PE_y	=	Project emissions in year y (tCO ₂), equal to zero for wind projects.
LE_y	=	Leakage emissions in year y (tCO ₂), equal to zero for wind projects.

For wind projects, baseline emissions are given by:

$$(2) \quad BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$

Where:

BE_y	=	Baseline emissions in year y (tCO ₂)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{grid,CM,y}$	=	Combined margin CO ₂ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO ₂ /MWh)

As stated by the “Tool to calculate the emission factor for an electricity system”, the baseline emission factor consists of a weighted average between an *operating margin* (OM) and a *build margin* (BM). The operating margin captures the project’s effect on the operation of the power

³⁵ As stated by the tool for the demonstration and assessment of additionality, CDM projects are not to be included in this analysis. [Original footnote as per registered PDD]

³⁶ This section was re-written in version 4 of the PDD to comply with the new version of the methodology.

plants that are already part of the grid. This impact occurs because once the new project enters the system, the latter's operator has to adjust the output of the other plants in response to the generation of the new project. This adjustment consists mostly in *reducing* the output of those plants with high marginal costs, mainly, thermal plants based on fossil fuel combustion.

On the other hand, the build margin attempts to capture the project's effect on the construction of new power plants. This accounts for the fact that by increasing generation, a project will increase reserve margins (relevant in centrally planned systems) and dampen price signals (that motivate new investments in free markets), which in turn implies that even a small project is likely to delay - if not directly displace - the commissioning of a new generation source.

The *combined* margin emission factor is calculated as the weighted average between the operating and the build margin emission rates. This way, in a hypothetical situation where the national grid consisted mostly of fossil fuel plants, but where recent additions are based on less polluting technologies, the operating margin's effect on the combined emission factor would be attenuated by a lower build margin. The opposite result would occur in a situation where renewable sources are the main components of the grid but with thermal plants becoming increasingly frequent amongst recent additions.

In the specific case of this project, the OM and the BM estimates were computed using the relevant time series from the *INE*³⁷ (Instituto Nicaragüense de Energía – Nicaraguan Energy Institute) -for the most recent years for which information was available. Also, *IPCC's Guidelines* (2006) and IEA's "*Energy Statistics Manual*"³⁸ (2007) were used to supplement the data provided by INE.

The tool for the estimation of the emission factor of an electric system determines the following six 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. In line with paragraph 18 of the tool, "the national grid definition should be used by default" in cases where the information required to demonstrate transmission constraints to define sub-grids is not available. The national grid in Nicaragua is unique, namely the "Sistema Interconectado Nacional" (National Interconnected System, NIS), i.e. there are no regional grids..

Electricity transfers from connected electricity systems are to be considered as electricity imports as per paragraph 19 of the tool. The NIS is connected to the Costa Rican and the Honduran electricity systems.

A graphic representation of the NIS can be found in the following link:
<http://www.cndc.org.ni/graficos/MapaSIN/index.php>.

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

Project participants are allowed to choose between the following two options to calculate operating margin and build margin emission factors:

- Option I: Only grid power plants are included in the calculation.

³⁷ This data is publicly available at <http://www.ine.gob.ni/>

³⁸ International Energy Agency <https://www.iea.org/publications/freepublications/publication/energy-statistics-manual.html>

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

As the NIS represents most of the national generation in Nicaragua, and considering the fact that the project delivers its electricity to the national grid, only grid connected plants will be included in the calculations (i.e. Option I is chosen).

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.

In Nicaragua, low cost/must-run resources are comprised solely by renewable energies. The latter constitute less than 50% of the total grid generation (average of the last five years), as seen in Table 1 below. Thus, option (a) (Simple OM) will be used in the context of this project activity.

Table 1 - Low cost/Must-run generation in the 2010-2014 period

Type	2010	2011	2012	2013	2014	Average
Renewables	34,7%	31,5%	40,2%	50,4%	52,0%	41,7%
Fossil fuels	65,3%	68,5%	59,8%	49,6%	48,0%	58,3%
Total	100%	100%	100%	100%	100%	100%

Source: Author's elaboration based on INE statistics (see baseline spread sheet attached)

Finally, the data vintage chosen for the estimation of the simple OM is the *ex-ante* option (paragraph 36), i.e. the emission factor is determined once at validation stage, which implies that no monitoring and recalculation of the factor during the crediting period will be required; three years of most recent data available will be used in the calculations.

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

The simple operating margin emission factor ($EF_{grid,OM-simple,y}$) is calculated based on the net electricity generation of each power unit and an emission factor for each power unit (option A on paragraph 41), as follows:

$$(3) \quad EF_{grid,OM-simple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OM-simple,y}$ = Simple operating 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)
$EF_{EL,m,y}$	=	CO ₂ emission factor of power unit m in year y (tCO ₂ /MWh)
m	=	All power units serving the grid in year y except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3 of the tool

As fuel consumption and electricity generation is available, option A.1 of the “Tool to calculate the emission factor for an electricity system” (version 04.0) is used:

$$(4) \quad EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO ₂ emission factor of power unit m in year y (tCO ₂ /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)
$EF_{CO2,i,y}$	=	CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /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

Note that by replacing equation (4) into equation (3) results in:

$$(5) \quad EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times \left(\frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}} \right)}{\sum_m EG_{m,y}}$$

This is the same as:

$$(6) \quad EF_{grid,OMsimple,y} = \frac{\sum_m \sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_m EG_{m,y}}$$

And finally:

$$(7) \quad EF_{grid,OMsimple,y} = \frac{\sum_{m,i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_m EG_{m,y}}$$

Equation (7) is thus algebraically equivalent to equations (3) and (4) combined. The latter is the formula used in our spreadsheet for the estimation of $EF_{grid,OMsimple,y}$. In our case, $i = diesel$,

fuel oil, and thus this last equation becomes the amount of emissions generating from diesel consumption ($FC_{diesel,m,y} \times NCV_{diesel,y} \times EF_{CO_2,diesel,y}$ for each m unit) plus the emissions coming from fuel oil consumption ($FC_{fuel_oil,m,y} \times NCV_{fuel_oil,y} \times EF_{CO_2,fuel_oil,y}$, also for each m unit), divided by total electricity generation provided by the plants in the set m (i.e. all power units serving the grid in year y except low-cost/must-run power units). This is the expression used in our spreadsheet for the estimation of $EF_{grid,OMsimple,y}$.

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.

Option 1 (*ex ante* build margin) is chosen for this project activity.

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 above³⁹:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5-units}$) and determine their annual electricity generation ($AEG_{SET-5-units}$, in MWh); according to the latest information available in Nicaragua, the last 5 power units to enter the grid were the Camilo Ortega Saavedra wind farm, unit #4 at NSEL (biomass) and three units from the Che Guevara IX thermal power plant. Their overall generation was $AEG_{SET-5-units} = 254,233$ MWh.

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total} , in MWh; in Nicaragua in 2014: $AEG_{total} = 2,576,375$ MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET \geq 20\%}$, in MWh); in our data, the set goes from Camilo Ortega Saavedra wind farm (commissioned in 2014) to the Unit #6 at the Che Guevara VII power plant (commissioned in 2010), with $AEG_{SET \geq 20\%} = 520,643$ MWh.

(c) From $SET_{5-units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); thus, according to INE data, $SET_{sample} = SET_{\geq 20\%}$.

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

³⁹ The calculations presented in this sub-section can be reproduced from the baseline spread sheet attached to the PDD (see the BM sheet).

ago, then use SET_{sample} to calculate the build margin. In our case, the eldest unit in the set (Unit #6 at Che Guevara VII power plant) was commissioned in 2010, less than 10 years ago and thus no further sub-steps are required to identify the set of plants included in the build margin.

The list of plants considered for the build margin is presented on the table below.

Table 2 – Summary of Build Margin Calculations

Unit Name	Entry date	Category	Fuel (i)	$NCVi \times EFi \times di$	Net Gen. in 2014 (MWh)	Accum gen.	$FC_{i,m} (10^3 \text{ gals})$	tCO ₂	EF_m (tCO ₂ /MWh)
Camilo Ortega Saavedra	2014	Renewable	Wind	0.0000	160,390	6.2%	0	0	0
NSEL-U#4	2012	Renewable	Bagasse	0.0000	30,179	7.4%	0	0	0
Che Guevara IX - U1 - U7	2011	Fossil Fuel	Fuel Oil	10.9583	146,230	13.1%	8,619	98,457	0.6733
			Diesel	9.6015			417		
Che Guevara VII - U1-U6	2011	Fossil Fuel	Fuel Oil	10.9583	183,844	20.2%	11,198	124,961	0.6797
			Diesel	9.6015			235		
TOTAL					520,643	20.2%		223,418	0.4291

Source: Author's elaboration based on INE (see baseline spread sheet attached for details)

The build margin emission 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. Each emission factor is calculated using the same equations (3) to (7) above, only replacing the relevant set of plants (m) for the set obtained above.

Step 6. Calculate the combined margin (CM) emissions factor

Once the operating and build margin emission rates are obtained, the *combined margin* (CM) was based in the option (a) "Weighted average CM" and is calculated according to the following expression:

$$(8) \quad EF_{grid,CM,2014} = EF_{grid,OMsimple,2012-2014} \omega_{OM} + EF_{grid,BM,2014} \omega_{BM}$$

Where:

$EF_{grid,CM,2014}$	=	Combined margin CO ₂ emission factor in year 2014 (tCO ₂ /MWh)
$EF_{grid,OMsimple,2012-2014}$	=	Generation weighted operating margin CO ₂ emission factor in years 2012-2014 (tCO ₂ /MWh)
ω_{OM}	=	Weighting of operating margin emissions factor (%)
$EF_{grid,BM,2014}$	=	Build margin CO ₂ emission factor in 2014 (tCO ₂ /MWh)
ω_{BM}	=	Weighting of build margin emissions factor (%)

For this project, $\omega_{OM} = 0.75$ and $\omega_{BM} = 0.25$ are the default values for all crediting periods (tool, paragraph 81).

The following tables summarize the results:

Table 3 - OM and BM emission factors calculations (summary)

Factor		Fuel Consumption (10 ³ gals)		Generation (MWh)	Emissions (tCO ₂)	Emission Factor (tCO ₂ /MWh)
		Fuel Oil	Diesel			
OM	2012	139,088	1,961	2,187,942	1,543,026	0.7052
	2013	117,869	1,822	1,930,779	1,309,156	0.6780
	2014	121,224	2,357	1,943,166	1,351,063	0.6953
	tot/avg (2012-2014)	378,181	6,141	6,061,886	4,203,245	0.6934
BM		19.817	652	520,643	223,418	0.4291

Source: Author's elaboration based on INE (see baseline spreadsheet attached for details)

Table 4 - CM emission factor calculations (summary)

$EF_{grid,OMsimple,2012-2014}$ (tCO ₂ /MWh)	=	0.6934
ω_{OM} (%)	=	75%
$EF_{grid,BM,2014}$ (tCO ₂ /MWh)	=	0.4291
ω_{BM} (%)	=	25%
$EF_{grid,CM,2014}$ (tCO ₂ /MWh)	=	0.6273

Source: Author's elaboration based in INE (see baseline spreadsheet attached for details)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$NCV_{i,y}$
Unit	TJ/Gg
Description	Net calorific value (energy content) per mass unit of fuel <i>i</i> in year <i>y</i> .
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	Fuel Oil: 39.8 TJ/Gg Diesel: 41.4 TJ/Gg
Choice of data or Measurement methods and procedures	No other data is publicly available. IPCC guidelines have been used in a conservative manner.
Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	$EF_{CO_2,i,y}$
Unit	tCO ₂ /TJ
Description	CO ₂ emission factor of fossil fuel <i>i</i> in year <i>y</i> .
Source of data	IPCC default values at the lower limit if the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National Greenhouse Gas Inventories.

Value(s) applied	Fuel Oil: 75.5 tCO ₂ /TJ Diesel: 72.6 tCO ₂ /TJ
Choice of data or Measurement methods and procedures	No other data is publicly available. IPCC guidelines have been used in a conservative manner.
Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	D_i
Unit	tons/gal
Description	Density of fuel i in year y .
Source of data	IEA Energy Statistics Manual (p. 181)
Value(s) applied	Fuel oil: 0.9634 kg/lit Diesel: 0.8439 kg/lit
Choice of data or Measurement methods and procedures	No regional or national data is publicly available. IPCC Guidelines (2006) do not provide information on density so another source had to be sought.
Purpose of data	Conversion from volume to mass units of fuel consumption data
Additional comment	-

Data / Parameter	$FC_{i,m,y}$
Unit	Thousand gals
Description	Amount of fossil fuel i consumed by each power plant/unit m in year y .
Source of data	INE - Instituto Nicaragüense de Electricidad (Nicaraguan Electricity Institute)
Value(s) applied	Data for the 2012-2014 period is available in the spreadsheet (Amayo_ER Calculation_Val2)
Choice of data or Measurement methods and procedures	Data is obtained from official sources
Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated and delivered to the grid by power plant/unit m in year y .
Source of data	INE - Instituto Nicaragüense de Electricidad (Nicaraguan Electricity Institute)
Value(s) applied	Data for the 2012-2014 period is available in the spreadsheet (Amayo_ER Calculation_Val2)
Choice of data or Measurement methods and procedures	Data is obtained from official sources

Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	Plant name
Unit	Text
Description	Identification of power sources for the OM (all the plants in the grid).
Source of data	INE- Instituto Nicaragüense de Electricidad (Nicaraguan Electricity Institute)
Value(s) applied	Data for the 2012-2013 period.
Choice of data or Measurement methods and procedures	Data is obtained from official sources
Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	Plant name
Unit	Text
Description	Identification of power sources for the BM (recent additions to the grid).
Source of data	INE- Instituto Nicaragüense de Electricidad (Nicaraguan Electricity Institute)
Value(s) applied	Data for the 2013 period as per table 2.
Choice of data or Measurement methods and procedures	Data is obtained from official sources
Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	$EF_{grid,OMsimple,2012-2014}$
Unit	tCO ₂ /MWh
Description	Simple operating margin CO ₂ emission factor in year y
Source of data	Input parameters described in this section.
Value(s) applied	0.6934 tCO ₂ /MWh (generation-weighted average for 2012-2014)
Choice of data or Measurement methods and procedures	As per applicable tool.
Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	$EF_{grid,BM,2014}$
Unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor in 2014
Source of data	Input parameters described in this section.
Value(s) applied	0.4291 tCO ₂ /MWh
Choice of data or Measurement methods and procedures	As per applicable tool.
Purpose of data	Combined margin emission factor calculation
Additional comment	-

Data / Parameter	$EF_{grid,CM,2014}$
Unit	tCO ₂ /MWh
Description	Combined margin CO ₂ emission factor in 2014
Source of data	Input parameters described in this section.
Value(s) applied	0.6273 tCO ₂ /MWh
Choice of data or Measurement methods and procedures	As per applicable tool.
Purpose of data	Baseline emissions calculation.
Additional comment	-

B.6.3. Ex ante calculation of emission reductions

The amount of expected emission reductions per year for this second crediting period is given by equation (2). In monitoring reports, the ex-ante generation estimate will be replaced by actual, monitored electricity production at the project site. At a calculated combined margin emission factor for the 2nd monitoring period of 0.6273 tCO₂/MWh and considering the same expected generation as for the previous crediting period (169,512 MWh per year), results in an annual emission reduction estimate of 106,335 tCO₂.

B.6.4. Summary of ex ante estimates of emission reductions

Year⁴⁰	Baseline emissions (t CO₂e)	Project emissions (t CO₂e)	Leakage (t CO₂e)	Emission reductions (t CO₂e)
2016-2017	106,335	0	0	106,335
2017-2018	106,335	0	0	106,335
2019-2020	106,335	0	0	106,335
2020-2021	106,335	0	0	106,335
2021-2022	106,335	0	0	106,335
2022-2023	106,335	0	0	106,335
2023-2024	106,335	0	0	106,335
Total	744,345	0	0	744,345

⁴⁰ Each year goes from April 12th to April 11th of the following year.

Total number of crediting years	7			
Annual average over the crediting period	106,335	0	0	106,335

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	EG_y
Unit	MWh
Description	Electricity supplied to the grid by the project activity in period y
Source of data	Parameters $EG^{230kV}_{AMAYO,y}$, $EG^{13.8kV}_{PhaseI,y}$, $EG^{13.8kV}_{PhaseII,y}$, $EC^{230kV}_{AMAYO,y}$, $EC^{13.8kV}_{PhaseI,y}$ and $EC^{13.8kV}_{PhaseII,y}$, which are based on on-site metering system (same data submitted to INE / NIS).
Value(s) applied	169,512.20 MWh
Measurement methods and procedures	See section B.7.3 below.
Monitoring frequency	Data will be measured on site on an hourly basis; monthly records will be kept.
QA/QC procedures	- Meter should have a maximum error of $\pm 0.2\%$ and be calibrated periodically according to local standards for electricity transactions in the NIS. - Crosschecking of the data from the spreadsheet by comparing the delivered energy from the spreadsheet with the delivered energy specified in the invoices. Invoices reflect gross energy delivered to the grid, (i.e. the EG^{230kV}_{PhaseI} parameter), which is the main input for determining EG_y.
Purpose of data	Calculation of baseline emissions
Additional comment	See Section B.7.3 below.

Data / Parameter	$EG^{230kV}_{AMAYO,y}$
Unit	MWh
Description	Quantity of electricity delivered to the grid (230 kV transmission line) by the entire wind farm (Phase I + Phase II) in period y
Source of data	On-site metering system
Value(s) applied	169,512.20 MWh was assumed for EG_y ($EG^{230kV}_{AMAYO,y}$ is ultimately used to determine EG_y)
Measurement methods and procedures	SCADA system registers values automatically.
Monitoring frequency	Data will be measured on site on an hourly basis; monthly records will be kept.
QA/QC procedures	Meters should have a maximum error of $\pm 0.2\%$ and be calibrated periodically according to local standards for electricity transactions in the NIS.
Purpose of data	Calculation of baseline emissions (apportioning of electricity between Amayo Phase I and Amayo Phase II)

Additional comment	Please refer to section B.7.3 for more details on the monitoring of this parameter.
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Data / Parameter	$EG^{13.8kV}_{PhaseI,y}$
Unit	MWh
Description	Gross electricity generation in year y by Phase I, as measured in the 13.8 kV meter
Source of data	On-site metering system
Value(s) applied	169,512.20 MWh was assumed for EG_y ($EG^{13.8kV}_{PhaseI,y}$ is ultimately used to determine EG_y)
Measurement methods and procedures	SCADA system registers values automatically.
Monitoring frequency	Data will be measured on site on an hourly basis; monthly records will be kept.
QA/QC procedures	Meters should have a maximum error of $\pm 0.2\%$ and be calibrated periodically according to local standards for electricity transactions in the NIS. Invoices can be used to cross-check.
Purpose of data	Calculation of baseline emissions (apportioning of electricity between Amayo Phase I and Amayo Phase II)
Additional comment	Please refer to section B.7.3 for more details on the monitoring of this parameter.

Data / Parameter	$EG^{13.8kV}_{PhaseII,y}$
Unit	MWh
Description	Gross electricity generation in year y by Phase II, as measured in the 13.8 kV meter
Source of data	On-site metering system
Value(s) applied	169,512.20 MWh was assumed for EG_y ($EG^{13.8kV}_{PhaseII,y}$ is ultimately used to determine EG_y)
Measurement methods and procedures	SCADA system registers values automatically.
Monitoring frequency	Data will be measured on site on an hourly basis; monthly records will be kept.
QA/QC procedures	Meters should have a maximum error of $\pm 0.2\%$ and be calibrated periodically according to local standards for electricity transactions in the NIS. Invoices can be used to cross-check.
Purpose of data	Calculation of baseline emissions (apportioning of electricity between Amayo Phase I and Amayo Phase II)
Additional comment	Please refer to section B.7.3 for more details on the monitoring of this parameter.

Data / Parameter	$EC^{230kV}_{AMAYO,y}$
Unit	MWh
Description	Quantity of electricity consumed from the grid at the 230 kV transmission line by the entire wind farm (Phase I + Phase II) in period y
Source of data	On-site metering system
Value(s) applied	169,512.20 MWh was assumed for EG_y ($EC^{230kV}_{AMAYO,y}$ is ultimately used to determine EG_y)

Measurement methods and procedures	SCADA system registers values automatically.
Monitoring frequency	Data will be measured on site on a hourly basis; monthly records will be kept.
QA/QC procedures	- Meters should have a maximum error of $\pm 0.2\%$ and be calibrated periodically according to local standards for electricity transactions in the NIS. - Crosschecking of the data from the spreadsheet by comparing the consumed energy from the sheet against the consumption reported in the DTE ("Economic Transaction Document", issued by the dispatch center). In case of differences, the most conservative value (i.e. the one that results in the smallest number of ERs) shall be used.
Purpose of data	Calculation of baseline emissions (apportioning of electricity between Amayo Phase I and Amayo Phase II)
Additional comment	Please refer to section B.7.3 for more details on the monitoring of this parameter.

Data / Parameter	$EC^{13.8kV}_{PhaseI,y}$
Unit	MWh
Description	Electricity consumption in year y by Phase I, as measured in the 13.8 kV meter
Source of data	On-site metering system
Value(s) applied	169,512.20 MWh was assumed for EG_y ($EC^{13.8kV}_{PhaseI,y}$ is ultimately used to determine EG_y)
Measurement methods and procedures	SCADA system registers values automatically.
Monitoring frequency	Data will be measured on site on an hourly basis; monthly records will be kept.
QA/QC procedures	- Meters should have a maximum error of $\pm 0.2\%$ and be calibrated periodically according to local standards for electricity transactions in the NIS. - Crosschecking of the data from the spreadsheet by comparing the consumed energy from the sheet against the consumption reported in the DTE ("Economic Transaction Document", issued by the dispatch center). In case of differences, the most conservative value (i.e. the one that results in the smallest number of ERs) shall be used.
Purpose of data	Calculation of baseline emissions (apportioning of electricity between Amayo Phase I and Amayo Phase II)
Additional comment	Please refer to section B.7.3 for more details on the monitoring of this parameter.

B.7.2. Sampling plan

No sampling is involved in this monitoring plan.

B.7.3. Other elements of monitoring plan

General aspects

Since the Amayo Project Participants have chosen to use *ex-ante* emission factors, there is no need to recalculate each of the latter during the crediting period. Thus, the main variable that requires monitoring is the electricity generation from the proposed project activity that is delivered to the grid.

A second phase (Amayo Phase II Wind Power Project) of the wind farm with a total capacity of 23.1 MW was installed next to the project site. The facility, which consists of eleven wind turbines of 2.1 MW 60HZ Suzlon wind turbine generators model S88, begun operation in February 9th 2010 and has been fully operational since 18th March 2010. The electricity of this project is delivered to the grid through the same substation constructed for Phase I; however, Phase II has been managed as an independent project throughout: it has separate power purchase agreements, land agreements and is owned by a separate company. This second phase is also a registered CDM project (CDM ref. 5305).

The meter located at the 230 kV substation provides the net electricity generation for the entire wind farm; thus, net electricity generation by Phase I can be obtained directly from the latter until Phase II becomes operational (i.e., while Phase I is the only wind farm delivering energy to the substation). However, after Phase II begins operations, the amount of electricity delivered by each project will have to be determined.

Consorcio Eólico Amayo, S.A. (Phase I) and Consorcio Eólico Amayo Fase II, S.A. (Phase II) are located side by side on the same geographical area of the Department of Rivas. Both have their own collector for energy at 13.8 kV level that goes into one 13.8 kV bus bar at the Entrance of the low side of the transformer located at the 230 kV substation, which is the common point where Phase I and Phase II deliver power to the Nicaraguan Grid. Phase II connects into the same Substation that Phase I does since this is the nearest point to deliver power to grid. Said substation has one main 100 MVA transformer that can handle the total output of Phase I and Phase II, which is approximately 71 MVA at its peak. This way, Phase II has been able to connect to the grid faster by using the same Substation that Phase I is using.

The Normative “Normativa de Operación” in place allows two Commercial Agents to deliver energy through the same connection point. In case that the Energy Delivery Point is the same -as in this case- the energy produced by each Agent (Phase I and Phase II) must be identified at each Commercial Agent’s metering point⁴¹. If the latter are not of the same voltage as the delivery point, a calculation (which must be registered at the CNDC⁴²) may be established in order to account the exact amount of net energy provided by each agent⁴³.

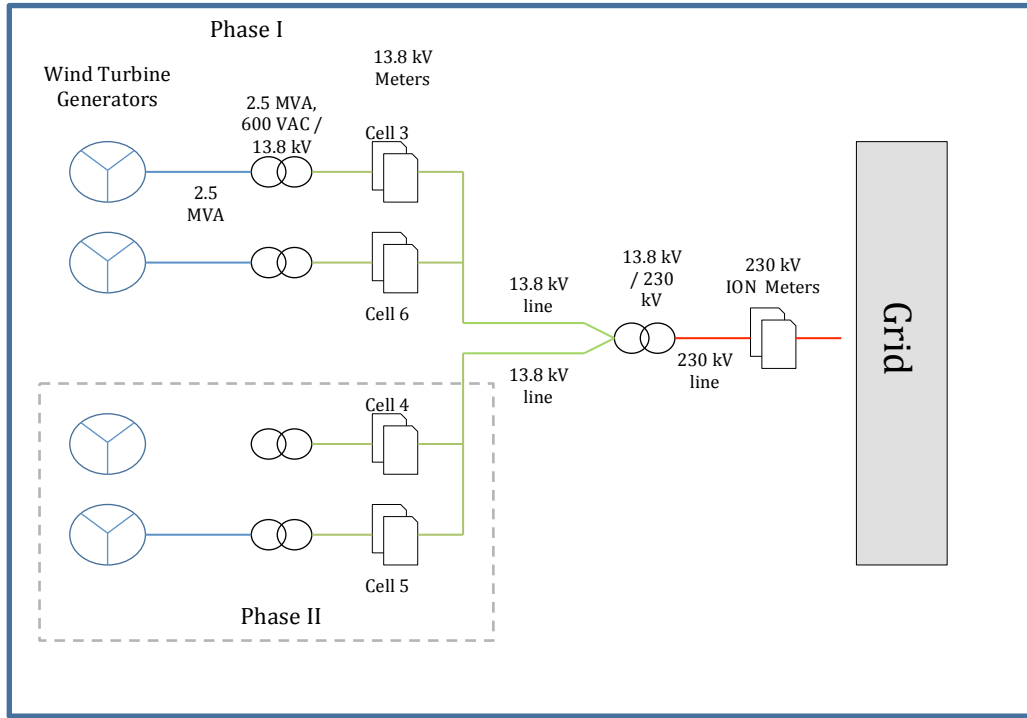
There will be meters on the low voltage (13.8 kV) side of the transformer, which will separately measure the exact production of Energy of Phase I and Phase II: two set of meters (main and backup for each phase). This will allow determining the fraction of electricity provided by each Phase to the grid corresponding to the overall net electricity delivery measured at the 230 kV substation (where another set of meters –main and backup- is installed. The metering scheme (comprising a total of 10 meters between main and backup units) is depicted on the figure below.

⁴¹ Recall that each Phase of the project is registered as an independent commercial agent.

⁴² National Load Dispatch Centre

⁴³ See section 4.1 (metering location) on page 2 of the Commercial Annex IV (Commercial Metering System) of the Operating Regulations (*Normativa de Operación*), available to the DOE (original document in Spanish).

Figure 3 - Metering scheme



Determination of net electricity

Electricity delivered to the grid will be determined as follows:

$$(9) \quad EG_{PhaseI,y}^{230kV} = \frac{EG_{PhaseI,y}^{13.8kV}}{EG_{PhaseI,y}^{13.8kV} + EG_{PhaseII,y}^{13.8kV}} \cdot EG_{AMAYO,y}^{230kV}$$

where:

$EG_{PhaseI,y}^{230kV}$	=	Gross energy delivered to the grid by Phase I in period y (MWh)
$EG_{AMAYO,y}^{230kV}$	=	Gross energy delivered by the entire wind farm (Phase I&II) in period y (MWh)
$EG_{PhaseI,y}^{13.8kV}$	=	Gross energy delivered by Phase I in period y as measured on the 13.8 kV internal meters (MWh)
$EG_{PhaseII,y}^{13.8kV}$	=	Gross energy delivered by Phase II in period y as measured on the 13.8 kV internal meters (MWh)

Internal consumption (i.e. energy consumed from the grid; EC_y) will be determined in an analogous fashion:

$$(10) \quad EC_{PhaseI,y}^{230kV} = \frac{EC_{PhaseI,y}^{13.8kV}}{EC_{PhaseI,y}^{13.8kV} + EC_{PhaseII,y}^{13.8kV}} \cdot EC_{AMAYO,y}^{230kV}$$

where:

$EC^{230kV}_{PhaseI,y}$	=	Electricity consumption from the grid by Phase I in period y (MWh)
$EC^{230kV}_{AMAYO,y}$	=	Electricity consumption by the entire wind farm (Phase I&II) in period y (MWh)
$EC^{13.8kV}_{PhaseI,y}$	=	Electricity consumption by Phase I in period y as measured on the 13.8 kV internal meters (MWh)
$EC^{13.8kV}_{PhaseII,y}$	=	Electricity consumption by Phase II in period y as measured on the 13.8 kV internal meters (MWh)

Thus, the *net* electricity generation will be obtained as⁴⁴:

$$(11) \quad EG_y = EG^{230kV}_{PhaseI,y} - EC^{230kV}_{PhaseI,y}$$

Technologic and managerial aspects

Suzlon wind turbines are bundled with specific software and hardware for data monitoring. The SC-Turbine software provides control for each single wind turbine, allowing for all process data to be monitored. Among the variables registered are rotation speed, wind conditions, component temperatures, electrical data and also production and operation hours. All historical and statistical data are stored on the controller flash memory, with 7 day storage capacity. A wind park server can download this data automatically to the wind park database as necessary. All this information data will be provided by SC-Turbine to the SC-Commander software, with which it is possible to read the data and create reports and statistics easily.

The project developer will implement a management structure where monitoring responsibilities will be explicitly defined. The O&M department's will be responsible for ERs monitoring, record keeping and the implementation of proper QA procedures, which include:

- In case that the delivered energy to the grid (gross energy) records used in the CERs calculation are not in accordance with the delivered energy specified in the invoices, then the most conservative data will be used for the CERs calculation.
- Calibration of the energy meters at least once every two years according to local standards by INE regulations (See page 9 of the Comercial Annex in the Operation Regulations issued by INE (in Spanish: *Normativa de Operación, Anexo Comercial: Sistema de Mediciones Comerciales, inciso VII.: Revisión de los medidores habilitados*). The calibration can be performed only by entities that are authorized or certified by the national authority CNDC (in English: National Dispatch Center).
- Storage of project data for at least 2 years after the end of the crediting period or the last issuance of CERs for this project activity.

All the information from this department will be consistent and easily verifiable with all the relevant data from other departments in case an external audit should require it.

All O&M procedures will be adapted to include the carbon monitoring component and the adequate accounting of the emission reductions.

The person in charge of the carbon credits monitoring will report to the O&M manager and will receive training in accordance with the owners training procedures. This individual area will be in charge of the following activities:

- Calculation and record keeping of the emissions reduced by the project activity, according to the general guidelines described in the monitoring plan.

⁴⁴ Notice that before the implementation of Phase II, $EG^{13.8kV}_{PhaseII} = 0$ and thus $EG^{230kV}_{PhaseI,y} = EG^{230kV}_{AMAYO,y}$

- Managing all the validation, registration and certification process of the project's GHG emission reduction.
- Coordination and management of the marketing of the CERs in the relevant carbon markets.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

This baseline and monitoring methodology application study was completed on 22/07/2015 by Martín Rodríguez Marat at Geo Ingeniería Ingenieros Consultores S.A., San José - Costa Rica.

- Phone: + (506) 2290 4656 / Fax: + (506) 2290 5297
- E-mail: info@geoingenieria.co.cr

The entity above is not considered a project participant.

SECTION C. Duration and crediting period**C.1. Duration of project activity****C.1.1. Start date of project activity**

The Project Start Date is 30/03/2007.

It is the date on which Consorcio Eolico Amayo S.A ("CEA"), Suzlon Wind Energy Portugal Ltda and Suzlon Wind Energy A/S executed the Wind Turbine System Supply and Installation Agreement (the "WTG Supply Agreement"). This was the first time that the project participants have committed to expenditures related to the implementation of the project. The supply agreement document evidences the date CEA signed the agreement for the supply of nineteen S88 V3 2.1 MW wind turbine generators and ancillary equipment.

C.1.2. Expected operational lifetime of project activity

This project has an estimated operational lifetime of 30 years corresponding to approximately 1.5 years which accounts for the construction period and 28.5 years of expected equipment operation.

Further operation of the plant will demand significant new investments.

C.2. Crediting period of project activity**C.2.1. Type of crediting period**

Renewable.

C.2.2. Start date of crediting period

First crediting period: 12/04/2009 (corresponding to version 3 of the PDD)

Second crediting period: 12/04/2016 (corresponding to the current version of this PDD).

C.2.3. Length of crediting period

7 (seven years).

SECTION D. Environmental impacts**D.1. Analysis of environmental impacts**

An environmental impact assessment (EIA) for the proposed project activity was conducted by the independent consultants Fiallos y Asociados between November 1998 and April 1999⁴⁵. The study was carried out by a multidisciplinary team upon request by ENISA and according to the regulations of the Nicaraguan DNA (Designated National Authority) MARENA (Ministerio del Ambiente y los Recursos Naturales, in English: Environment and Natural Resources Ministry). The following is the list of the areas covered in the study:

- Archaeology
- Characterization of the bodies of water
- Climate
- Geology
- Geo-technical exploration
- Noise study
- Socio-economics
- Soil study
- Vegetation and soil usage
- Forest fauna

The EIA concludes that the project is environmentally viable since the project's benefits (mainly its socioeconomic benefits to the people of Nicaragua) will compensate for its minor impact on the physical and biotic environment. Additionally, the EIA establishes an Environmental Management Plan to mitigate these impacts. Since the current environmental conditions are the same as those when the original study was carried out, MARENA has emitted an authorization to extend the validity of the EIA and the corresponding permits⁴⁶.

D.2. Environmental impact assessment

The EIA considered two main impact areas: the *natural* environment and the *social* environment. In order to evaluate the Amayo Wind Farm's impact on each of these areas, the project was divided into three stages: implementation, operation and dismantling.

The environmental impact study concludes that bird species are the component that may suffer the greatest harm during all of the project stages. During the implementation phase, the most negative impact will be the project's visual effect on the landscape. On the other hand, the project will greatly benefit local employment, especially during construction and dismantling stages.

Actions to mitigate and correct environmental impacts

The following is a brief summary of the environmental action plan that will be implemented throughout the different stages of the proposed project in order to mitigate the latter's negative impacts while enhancing its positive ones. Among the main measures aimed at reducing the project's impact are the following:

⁴⁵ However at this time the project was never implemented as explained in Section B.5.

⁴⁶ A summary of the EIA 99 study, together with the EIA 2006 and the original environmental permit and its renewal are available upon request by the DOE.

- **Birds and Land Fauna:** In order to prevent to the greatest extent possible the collision of birds (specially migratory species), sonic deterrents will be placed in strategic places in order to repel birds from flying dangerously close to the turbine's blades. In addition to this, ornithological monitoring will be carried out during the periods of heaviest bird migration (March to May and September to November).
- **Landscape:** In order to minimize their impact on landscape, all the towers and their complementary elements meet international design standards. The installation of wind towers on lands of high ecological value will be avoided.
- **Soil:** During the project's construction and dismantling phases, it will be necessary to clear the sites where the generation towers will be installed. This will affect the soil by leaving it exposed to erosion due to water runoff. Therefore, once the above-mentioned stages are concluded, the uprooted vegetation will be replanted to prevent soil erosion. As for the provisory camping sites, the areas with non-perennial vegetation will be selected in order to prevent the falling of trees.
- **Air:** Water will be poured to the dirt roads surrounding the project area so as to prevent the suspension of dust particles in the air.
- **Superficial waters and aquatic fauna:** During the installation and dismantling stages of this kind of projects, inadequate disposals of lubricant wastes are likely to occur affecting the natural bodies of water they may reach. To prevent this, lubricant wastes will be stored in safe barrels, thus facilitating their final disposal.
- **Noise:** To prevent the influence of noise generated by the rotor blades, a minimum distance of 300 to 500 meters will be considered between the wind turbines and any households in the area.
- **Flora:** The wind field will be constructed in open areas so as to avoid damaging existing forest areas. Similarly, the project participants will promote reforestation as a complementary activity, along with a program to protect the natural flora of the project's site, thus conserving the area's existing bio-diversity.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

The stakeholder presentation took place on Thursday May 29th, 2008, at 2:00 p.m. in the Nicarao Inn Hotel in the city of Rivas, Nicaragua.

The main objectives of this presentation were: (a) to inform the local stakeholders of the project activity and its characteristics as a CDM project; and (b) to gain insights on local concerns and opinions regarding the project activity.

Activities in preparation for the event are described below:

A preliminary research and selection for invitees was carried out by Consorcio Eólico Amayo S.A. (CEA). After the selection of the organizations and people, CEA delivered personalized invitation cards on site. The Project is located in the Municipality of Rivas, which is located in the Department of Rivas. The Municipality of Rivas has the local offices of the governmental institutions which were also invited.

The selected stakeholders were: the local government, including many of the governmental institutions, universities, schools, NGOs and neighbours from the Project's surroundings (which consist on landowners), and representatives of the local government from other communities of Rivas's Department.

Also CEA delivered personalized invitation cards to several institutions of the national government in the capitol of Managua.

CEA and the DNA also announced the stakeholder presentation in the most popular newspaper in Nicaragua: "La Prensa" on May 19th, 2008, more than one week before the event.⁴⁷ The DNA also announced that the PDD was available for public comments in ONDL's website and in MARENA's offices in Rivas since May 19th until May 26.

More than 35 participants attended the stakeholder presentation representing a total of around 16 organizations, institutions and communities, mostly located around the project site but also coming from the capital of Nicaragua, Managua.

Phases of the stakeholder presentation:

At the entrance of the conference room the registration process was carried on and a brochure with specific information from the Amayo project was handed out as well as a paper form in which the assistants could write their questions and/or comments related to the project.

The public consultation started with a Power Point presentation that explained the project's features regarding its technology, construction, operation, mitigation measures and Clean Development Mechanism aspects.

After the presentation an open question round was held. A video of the entire stakeholder presentation is available and can be submitted upon request. A summary of the questions and comments can be found in section E.2.

E.2. Summary of comments received

No comments were submitted in the ONDL's website during the week (May 19-26) established by the DNA for public comments.

At the end of the stakeholder presentation, some comments and questions were exposed by the participants. The main topics exposed are summarized below:

The participants had questions on how the project will benefit the local economy and how it is going to be integrated within the local government, municipalities, and communities, in general which is going to be the link between the project and the municipalities, so they can benefit from the project.

Other participants had questions on when the project is going to be operational and whether or not it is possible in the country to combine eolic energy with other renewable sources like geothermal and hydro. Others asked about the wind potential in Rivas. Also they asked if the project's capacity could be expanded, where and when is it planned to be. Other person asked about the value of the CERs and how they were included in the financial analysis of the project.

A professor from a university in Rivas (Universidad Politécnica) wanted to know if they have information about the project to give to the students.

At the end of each question, satisfactory and comprehensive answers were provided to all concerned.

Only positive comments were received by the participants, who highlighted the benefits of the project, mainly they said that taxes are going to be distributed among inhabitants, the benefits of

⁴⁷ Respective copies of the announcements are available upon request.

using the wind will have a positive impact in energy prices and therefore the Nicaraguan people will benefit from that.

Another benefit they mentioned is that the use of a renewable resource will reduce the country's consumption of imported fuel oil by a specific amount of oil barrels, therefore improving the Nicaraguan current account and reducing the currency expenditures that can be used internally around the Country.

No negative comments or concerns were received.

E.3. Report on consideration of comments received

The Consorcio Eólico Amayo clarified all the stakeholder's concerns by providing relevant data and answered all question to the satisfaction of the participants. Detailed Minutes of meeting delineating the above questions and CEA's responses have been recorded and written down. These are available upon request.

The Consorcio Eólico Amayo also informed the stakeholders that the project activity would contribute to the sustainable development of the region and country by facilitating and catalyzing local and regional opportunities, thereby creating sustainable shareholder, economic, social and environmental value.

Finally, it's important to emphasize that the entire project complies with environmental laws and their respective requirements and most important that residents and the local government are all very supportive of the proposed project activity.

SECTION F. Approval and authorization

LoA from Nicaragua: issued on 05/09/2008;

LoAs from other parties:

United Kingdom of Great Britain and Northern Ireland: issued on 05/10/2010.

Switzerland: issued on 30/05/2012.

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Consortio Eólico Amayo S.A.
Street/P.O. Box	Planes de Altamira III Etapa, Edificio CAR II, Primer Piso
Building	CAR II
City	Managua
State/Region	Managua
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Country	Nicaragua
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Fax	-
E-mail	mariana.barrios@icpower.com.ni
Website	-
Contact person	Mariana Barrios
Title	CDM Coordinator
Salutation	Ms
Last name	Barrios
Middle name	-
First name	Mariana
Department	Amayo's Environmental Department
Mobile	505-89276278
Direct fax	-
Direct tel.	505-22935033
Personal e-mail	mariana.barrios@icpower.com.ni

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
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Website	http://www.shell.com
Contact person	Ziyuan Wang
Title	Ms.
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Last name	Wang
Middle name	-
First name	Ziyuan
Department	CO2 Business Portfolio
Mobile	-
Direct fax	+44 2076329813
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Personal e-mail	stascoeptb@shell.com

Appendix 2. Affirmation regarding public funding

There is no public funding in this project.

Appendix 3. Applicability of methodology and standardized baseline

All details provided in section B.

Appendix 4. Further background information on ex ante calculation of emission reductions

All details provided in section B; see also attached spreadsheet (Amayo_ER Calculation_Val2).

Appendix 5. Further background information on monitoring plan

All details provided in section B.

Appendix 6. Summary of post registration changes

A revised monitoring plan was approved on 08/09/2011, during the project's first crediting period, to allow for the apportioning of electricity between Phase I and Phase II of the project. Said monitoring plan is the exact same one included in the current version of this PDD.

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from <i>F-CDM-PDD</i> to <i>CDM-PDD-FORM</i>; • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Registration Keywords: project activities, project design document		