



Amayo 40 MW Wind Power Project - Nicaragua

UNFCCC Clean Development Mechanism Monitoring Report Version 5

CDM Registration Number 2315
Monitoring Period: From April 12, 2009
to September 30, 2009 (both dates included)
Issue Date: February 19th, 2010

Done by: Mariana Barrios Jackman
Environmental Coordinator

1. Introduction

The Monitoring Report for Amayo 40 MW Wind Power Project - Nicaragua presents the emission reductions achieved by the project activity in the period covered (from April 12th 2009 to September 30th 2009), and to serve as the basis for the verification of these reductions and issuance of the CER's.

The initial date for the accreditation period for this first verification for the CER's is April 12th 2009, since this was the date in which the project was registered as a CDM project by the UNFCCC, under reference number 2315: Amayo 40 MW Wind Power Project - Nicaragua. More background information can be found in the Project Design Document (PDD) and related documents, available on the UNFCCC website: <https://cdm.unfccc.int/Projects/DB/SGS-UKL1227712726.26/view>

2. Project Description

2.1 Title and company description

- Amayo 40 MW Wind Power Project - Nicaragua.
- Consorcio Eólico Amayo, S.A., a Panamanian corporation operating in Nicaragua through a Nicaraguan branch has been established by affiliates of Arctas Capital Group LP, Centrans Energy Services, Inc. and ENISA, to collectively develop the project.

2.2 Geographic Location

The Amayo site is located 129 kilometers 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 wind farm is centered at the geographical coordinates 11°19'32" N and 85°43'05" W.

2.3 Project Status

The Amayo 40 MW Wind Power Project - Nicaragua is the first wind-power plant in Nicaragua and is fully operational, consisting on nineteen 2.1 MW wind turbines, for a total installed capacity of 39.9 MW. Amayo wind farm was connected to the grid 9 February 2009 and started to produce electricity 12 February 2009, as the first days were required to energize the main transformer and test the electrical circuits.

During this period the main revenue meter was audited in order to correct a defect that presented 29 April 2009, meanwhile the energy produced was measured using the backup meter. The revenue metering system consists of main and backup meters both of the same characteristics to assure that if one fails the energy records will be accurate. This was done following the procedures in the Operational Normative “Normativa de Operación” that applies to the Generation sector.

A second phase of the wind farm is currently under construction with a total capacity of 23.1 MW, installing 11 wind turbines of 2.1 MW each one. This second project has a separate power purchase agreement and is owned by a separate company. This second phase also intends to be registered as a CDM project.

3. Monitoring Process and Results

3.1 Presentation of Monitoring Results

Emission Reductions

The calculated emission reductions for this monitoring period are **42,871 tCO₂e**. This results are presented in the attached excel book “Carbon Credits Analysis CERs.xlsx”.

Presentation of Monitoring Results

The excel book contains two sheets:

- *Summary*, which contains a monthly overview of the calculation of net power delivered to the grid and project baseline emissions; and
- *CERs Analysis*, which presents detailed emissions reductions calculations on an hourly basis. Input data is taken from the Project’s operational data base and pasted into the spreadsheet.

4. Baseline and Monitoring Methodology Applied

The Amayo 40 MW Wind Power Project - Nicaragua uses the approved baseline and monitoring methodology ACM0002 (Version 07 – December 2007): “*Consolidated baseline methodology for grid – connected electricity generation from renewable sources*”.

Using ACM0002, the emission reductions achieved by any project activity can be calculated by subtracting *project* emissions from *baseline* emissions. The latter are obtained by multiplying the net electricity (MWh) supplied to the grid by the grid’s combined margin emission factor (in this case, 0.7127 tCO₂ / MWh). Since the Amayo 40 MW Wind Power Project uses a renewable, zero-emissions source, project emissions are zero. Therefore, emissions reductions equal baseline emissions.

The following tools were applied together with the methodology:

- “Tool to calculate the emission factor for an electricity system” (Version 01).
- “Tool for the demonstration and assessment of additionality” (Version 05).

4.1 Calculation Methodology and Monitoring System

The parameter monitored is the electricity supplied to the grid by the project activity (EGy), as indicated in the PDD section B.7.1.

The electricity supplied to the national grid is continuously measured and recorded by the revenue metering system that consists of a main meter and a back up meter, both installed at the plant facilities. Calibration of the metering system is done every two years, according to the national norm “Normativa de Operación”.¹ The table below shows the calibrations done to the metering system.

¹ Both meters are calibrated according to the specifications presented in section B.7.1 of the PDD.

Table 1: Calibrations of the metering system

Meter	Calibration date	Certificate number /issued by:	Validation of the calibration
Main Meter Schneider Electric, Power Logic, ION 8600, serial No.: PT-0901A531-01	June 14, 2009	Issued by AMELEC ² (Standard ID: RM-10-06- Serial # 508071 & Calibrator ID: UTEC 441-Serial # B0201).	2 years according to the nicaraguan norm Normativa de Operación.
	March 31, 2009	Issued by AMELEC (Standard ID: RM-10-06 – Serial # 508071 & Calibrator ID: UTEC 441 – Serial # B0201).	2 years according to the nicaraguan norm Normativa de Operación.
	No date	Certification of Compliance and Calibration (manufacturer certificate) No. 70052-0224-02/ Issued by Power Logic, Schneider Electric.	1 year
	January 30, 2009	Certification of Compliance and Calibration (manufacturer certificate) No.: 70052-0225-03 Issued by Power Logic, Schneider Electric	1 year
Back Up Meter Schneider Electric, Power Logic, ION 8600, serial No.: PT-0901A532-01	June 14, 2009	Issued by AMELEC (Standard ID: RM-10-06- Serial # 508071 & Calibrator ID: UTEC 441-Serial # B0201).	2 years according to the nicaraguan norm Normativa de Operación.
	March 31, 2009	Issued by AMELEC (Standard ID: RM-10-06- Serial # 508071 & Calibrator ID: UTEC 441-Serial # B0201).	2 years according to the nicaraguan norm Normativa de Operación.
	No date	Manufacturer Certificate No.70052-0224-02, Issued by Power Logic, Schneider Electric	1 year
	January 30, 2009	Manufacturer Certificate No. 70052-0225-03 / Issued by Power Logic, Schneider Electric.	1 year

Note: The calibration in June corresponds to the last calibration for both meters. The calibration in January is the calibration done by the manufacturer.

The data readings used for the monitoring and calculation methodology is taken from the revenue metering system, which keeps track of both the electricity supplied and received from the grid. Daily records are kept by the plant operator in the operation data files. Additionally these same files are kept in back up CD's.

In turn, net energy delivered is used to calculate baseline emissions. The input data is pasted into the spreadsheet “*CERs Analysis*” to calculate the net energy, which is given subtracting the received energy from the delivered electricity to the grid. The net energy delivered in each hour is multiplied by the Nicaraguan emission factor to obtain baseline emissions. The emission factor for Amayo 40 MW Wind Power Project - Nicaragua is 0.7127 tCO₂ / MWh³.

The calculation of net energy and emission reductions for April involved some factors that are explained as follow:

² These certificates were issued by AMELEC (in spanish Asesoría y Materiales Eléctricos) which is a specialized and certified organization for calibration and meter audits.

³ As indicated in the PDD, project participants chose an *ex-ante* emission factor, which was calculated and presented in sections B.6.1 and B.6.3 of the above mentioned document.

1. First, on April 29th the main meter had a failure which was reflected on a difference in the input data of 15.7 MW between the readings of the main and back up meters⁴. For this reason the input data from the back up meter was used for the days of 29th and 30th of April in order to calculate the net energy and the emission reductions. The difference between both meters can be shown in the table below.

Table 2: Energy measured by the metering system for April 2009

Delivery energy (MWh) for April from the Main Meter (i)	Delivery energy (MWh) for April using input data from the back meter for April 29th and 30th (ii)	Difference in Delivered energy due to main meter fault (MWh) (iii) = (i)-(ii)
16,299.2	16,314.9	-15.7

2. Since the registration of the project as a CDM project was on April 12th, it is necessary to subtract the energy generation from April 1st to April 11th (both included) in order to obtain the emission reductions only from April 12th to 30th (both included). As told before for this calculation, the input data from the back up meter was used for the days of 29th and 30th of April, and the rest of this period from the main meter. The table below shows net energy separately for both periods of April.

Table 3: Net energy for April 2009

April 1 st to 11 th (both included)			April 12 th to 30 th (both included) CER's		
Delivery energy (MWh) (a)	Received energy (MWh) (b)	Net energy (MWh) (c)=(a)-(b)	Delivery energy (MWh) (d)	Received energy (MWh) (e)	Net energy (MWh) (f)=(d)-(e)
4,265.0	4.6	4,260.4	12,049.9	1.3	12,048.5

3. The input data from the meters from April 12th to April 30th was pasted into the spreadsheet "CERs Analysis" to calculate the net energy, which is derived by

⁴ A letter from ENATREL issued on 2009/06/05 shows the energy not registered by the main meter, but generated, as presented in table 2.

subtracting the received energy from the delivered electricity. The net energy for each hour was multiplied by the Nicaraguan emission factor to obtain the emissions reductions (as shown in the spreadsheet CERs Analysis).

Since the beginning of operation, there have been months where the electricity generations varied from the generation forecasted. Initially, the project experienced lower generation due to delays in commissioning the wind turbines which were brought on line one by one, commencing in February 2009. Once all the turbines were commissioned, the project experienced more high wind days than forecasted which in turn led to higher than forecasted electricity revenues. Once in operation, the wind turbine generators have produced electricity in accordance with manufacturers certified power curves.

A comparison between the targeted values and the actual values for both net energy and emissions reductions can be shown in the table below for each month.

Table 4: Comparison between targeted values and actual values for emission reductions

Month	Targeted Values		Actual Values	
	Net Energy (kwh)	Emissions Reductions (tCO2e)	Net Energy (kwh)	Emissions Reductions (tCO2e)
April	24635,147.00	17,557.47	12048,550.00	8,587.00
May	9483,269.00	6,758.73	9976,300.00	7,110.11
June	8361,489.00	5,959.23	4274,290.00	3,046.29
July	9878,355.00	7,040.30	14162,940.00	10,093.93
August	5265,544.00	3,752.75	11706,990.00	8,343.57
September	5165,000.00	3,681.10	7984,000.00	5,690.20

Note: CER's are calculated using the EF of 0.7127 per MWh.

For the targeted values for April the column shows the estimated net energy for the whole month. For the actual values in April the table only shows the values from the 12th to 30th both included, due that the project was registered as a CDM project on April 12th. That is one reason why the CERs for this month were lower than forecasted. Differences are also related to delays in commissioning the wind turbines which were brought on line one by one. As of the second half of April 2009 not all of the wind turbines had been fully commissioned (only 16 wind turbines). In fact Amayo's availability factor during April was 86.27%.

The CERs generated for May were close to the forecasted CERs. In the case of June the CERs were lower than forecasted because the availability factor was also below 90% (around 86.36%).

In the case of July, August and September the CERs generated were higher than forecasted. During these three months the wind conditions were better than expected for this period of the year as a result of the phenomenon of El Nino. These higher than average wind speeds and an improved plant availability (above 90% for these months) resulted in greater than expected displacement.

4.1.1 QA / QC procedures applied

Crosschecking of the data from the spreadsheet is done through:

- Comparing the delivered energy from the spreadsheet with the delivered energy stated in the invoices;
- Comparing the delivered and net energy from the spreadsheet with the delivered and net energy from the monthly production report done by Operations Office.
- The calculation worksheet which is done by the Environmental Coordinator and verified by the Operations Manager.

4.2 Summary of Baseline Emission Calculations

Table 5 - Emission reductions calculation

Period	(I) Net Energy (MWh)	(II) EF (tCO ₂ e/MWh)	(III) Baseline Emissions (tCO ₂ e)	(IV) Project Emissions (tCO ₂ e)	(V) Emission Reductions (tCO ₂ e)
April (from April 12th 2009, included)	12048.55	0.7127	8587.00	0	8587.00
May	9976.30	0.7127	7110.11	0	7110.11
June	4274.29	0.7127	3046.29	0	3046.29
July	14162.94	0.7127	10093.92	0	10093.92
August	11706.99	0.7127	8343.57	0	8343.57
September	7984.15	0.7127	5690.31	0	5690.31
TOTALS	60,153.21		42,871.20	0	42,871