COSTA RICA GROUPED WIND PROJECT

Document Prepared By Geo Ingeniería Ingenieros Consultores S.A.

San José, Costa Rica
Tel: + (506) 2290 4656 / Fax: + (506) 2290 5297
info@geoingenieria.co.cr
www.geoingenieria.co.cr

Project Title	Costa Rica Grouped Wind Project
Version	02
Date of Issue	12-June-2017
Prepared By	Geo Ingeniería Ingenieros Consultores S.A.
Contact	San José, Costa Rica – info@geoingenieria.co.cr (506) 2290-4656 - www.geoingenieria.co.cr

TABLE OF CONTENTS

1 Project Details ... 3
1.1 Summary Description of the Project ... 3
1.2 Sectoral Scope and Project Type ... 4
1.3 Project Proponent ... 4
1.4 Other Entities Involved in the Project ... 5
1.5 Project Start Date ... 5
1.6 Project Crediting Period ... 6
1.7 Project Scale and Estimated GHG Emission Reductions or Removals ... 6
1.8 Description of the Project Activity ... 7
1.9 Project Location ... 10
1.10 Conditions Prior to Project Initiation ... 11
1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks ... 12
1.12 Ownership and Other Programs ... 13
1.12.1 Project Ownership ... 13
1.12.2 Emissions Trading Programs and Other Binding Limits ... 13
1.12.3 Other Forms of Environmental Credit ... 13
1.12.4 Participation under Other GHG Programs ... 13
1.12.5 Projects Rejected by Other GHG Programs ... 13
1.13 Additional Information Relevant to the Project ... 14
2 Application of Methodology ... 15
2.1 Title and Reference of Methodology ... 15
2.2 Applicability of Methodology ... 15
2.3 Project Boundary ... 17
2.4 Baseline Scenario ... 20
2.5 Additionality ... 20
2.6 Methodology Deviations ... 30
3 Quantification of GHG Emission Reductions and Removals ... 30
3.1 Baseline Emissions ... 30
3.2 Project Emissions ... 38
3.3 Leakage ... 38
3.4 Net GHG Emission Reductions and Removals ... 38
4 Monitoring ... 42
4.1 Data and Parameters Available at Validation ... 42
4.2 Data and Parameters Monitored ... 44
4.3 Monitoring Plan ... 50
5 Safeguards ... 55
5.1 No Net Harm ... 55
5.2 Environmental Impact ... 59
5.3 Local Stakeholder Consultation ... 60
5.4 Public Comments ... 66

1 PROJECT DETAILS

1.1 Summary Description of the Project

Costa Rica Grouped Wind Project (hereafter referred to as "the grouped project") is implemented by Alisios Holdings S.A. (hereafter referred to as "the project owner"), and aims to generate electricity by using renewable wind energy to the Costa Rican grid. The grouped project is being coordinated by Alisios Holdings S.A., which will work closely with the developers (100% owned by Alisios Holdings, S.A.) of the wind power plants and with other organizations active in the energy sector in the host country to facilitate the development of new power plants and its further inclusion into this Grouped Project.

The grouped project consists in new-build wind energy plants located in Costa Rica. The initial project activity instances included in the grouped project are:

1. INSTANCE 1: Campos Azules 20 MW Wind Project (hereafter referred to "Campos Azules Project"), located in Tilarán, Guanacaste Province of Costa Rica. The Campos Azules Project will be developed and managed by Inversiones Eólicas Campos Azules S.A. and will generate electricity by means of a renewable, clean and affordable source: the wind. This project will have an installed capacity of 20 MW, 10 units of 2 MW, 9 (nine) G90 and 1 (one) G87 GAMESA turbines with a hub height of 78m, and will have an expected amount of electricity to be generated of approximately 93,431 MWh/year which will be transmitted into Costa Rica's national electricity grid.

2. INSTANCE 2: Altamira 20 MW Wind Project (hereafter referred to "Altamira Project", located in the Santa Rosa district in the Tilarán canton, in the province of Guanacaste, Costa Rica. Altamira Project will be developed and managed by the company Inversiones Eólicas Guanacaste S.A. and will generate electricity by means of a renewable, clean and affordable source: the wind. This project will have an installed capacity of 20 MW, 10 units of 2 MW G90 GAMESA turbines with a hub height of 78 m and will have an expected amount of electricity to be generated of approximately 86,606 MWh/year which will be transmitted into Costa Rica's national electricity grid.

3. INSTANCE 3: Vientos de Miramar 20 MW Wind Project (hereafter referred to "Miramar Project", located in the Cañas Dulces and Mayorga district, of the Liberia Canton, in the province of Guanacaste, Costa Rica. Miramar Project will be developed and managed by the company Costa Rica Energy Holding S.A. and will generate electricity by means of a renewable, clean and affordable source: the wind. This project will have an installed capacity of 20 MW, 10 units of 2 MW, 5 (five) G87 GAMESA turbines with a hub height of 78 m and 5 (five) G87 GAMESA turbines with a hub height of 90 m and will have an expected amount of electricity to be generated of approximately 99,833 MWh/year which will be transmitted into Costa Rica's national electricity grid.

4. INSTANCE 4: Vientos de la Perla 20 MW Wind Project (hereafter referred to "La Perla Project", located in the Mayorga district, of the Liberia Canton, in the province of Guanacaste, Costa Rica. La Perla Project will be developed and managed by the company

Vientos del Volcán S.A. and will generate electricity by means of a renewable, clean and affordable source: the wind. This project will have an installed capacity of 20 MW, 10 units of 2 MW G87 GAMESA turbines with a hub height of 78 m and will have an expected amount of electricity to be generated of approximately 102,764 MWh/year which will be transmitted into Costa Rica's national electricity grid.

This technology/measures will help to reduce the GHG emissions produced by the fossil fuel based power plants of the national grid of Costa Rica, by the implementation of the grouped project.

According to the ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" version 17.0.0, the baseline for a project activity that consists in the installation of a Greenfield power plant (which is the case of the project) is the following:

"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system". The latter is the scenario existing prior to the implementation of the project activity.

The estimated annual generation of the initial four project activity instances is **382,634 MWh**, thus the average GHG emission reductions is 92,710 tCO2e and the total estimate GHG emissions reductions over the first crediting period is 927,100 tCO2e.

1.2 Sectoral Scope and Project Type

The Project falls under UNFCCC CDM sectoral scope 01, "Energy Industries (renewable- /non-renewable resources)".

Project type: Renewable Energy

The project is a grouped project.

1.3 Project Proponent

Organization name	**ALISIOS HOLDING, S.A.**
Contact person	Jay Gallegos
Title	President
Address	Centro Corporativo El Cedral, Tower 1, 1st floor, Office 111 Escazú, San José, Costa Rica
Telephone	+506 2228-9300
Email	lumana@dencmi.com

1.4 Other Entities Involved in the Project

Organization name	**INVERSIONES EÓLICAS GUANACASTE, S.A.**
Role in the project	Developer of Altamira Wind Project
Contact person	Jay Gallegos
Title	President
Address	Centro Corporativo El Cedral, Tower 1, 1st floor, Office 111 Escazú, San José, Costa Rica
Telephone	+506 2228-9300
Email	lumana@dencmi.com

Organization name	**INVERSIONES EÓLICAS CAMPOS AZULES, S.A.**
Role in the project	Developer of Campos Azules Wind Project
Contact person	Jay Gallegos
Title	President
Address	Centro Corporativo El Cedral, Tower 1, 1st floor, Office 111 Escazú, San José, Costa Rica
Telephone	+506 2228-9300
Email	lumana@dencmi.com

Organization name	**COSTA RICA ENERGY HOLDING, S.A.**
Role in the project	Developer of Miramar Wind Project
Contact person	Jay Gallegos
Title	President
Address	Centro Corporativo El Cedral, Tower 1, 1st floor, Office 111 Escazú, San José, Costa Rica
Telephone	+506 2228-9300
Email	lumana@dencmi.com

Organization name	**VIENTOS DEL VOLCAN, S.A.**
Role in the project	Developer of La Perla Wind Project
Contact person	Jay Gallegos
Title	President
Address	Centro Corporativo El Cedral, Tower 1, 1st floor, Office 111 Escazú, San José, Costa Rica
Telephone	+506 2228-9300
Email	lumana@dencmi.com

1.5 Project Start Date

The following table showed the commission time of the initial four project activity instances included in the grouped project, on which the project began generating GHG emission. The grouped project started on 09/12/2016, which is earliest commission date of the initial four project activity instances.

Table 1. Commissioning dates of the Project Instances

INSTANCE	COMISSION DATE
1. Campos Azules 20 MW Wind Project	09/12/2016
2. Altamira 20 MW Wind Project	17/01/2017
3. Vientos de Miramar 20 MW Wind Project	03/06/2017
4. Vientos de la Perla 20 MW Wind Project	03/06/2017

1.6 Project Crediting Period

The first crediting period of the grouped project is 10 years, from 09/12/2016 to 08/12/2026 (Renewable two times).

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	X
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	92,710
Year 2	92,710
Year 3	92,710
Year 4	92,710
Year 5	92,710
Year 6	92,710
Year 7	92,710
Year 8	92,710
Year 9	92,710
Year 10	92,710
Total estimated ERs	927,100
Total number of crediting years	10
Average annual ERs	92,710

1.8 Description of the Project Activity

The grouped project consists in new-build wind energy plants located in Costa Rica. The functional layout of the Projects consists of all the main elements of a wind farm: wind turbines, wind measuring stations, an operations building (with metering equipment), and internal roads between turbines and the interconnection to an existing electrical substation.

The following section presents a summary of the main technical aspects of the each of the projects. The two proposed Project WTGs are the G87-2MW CS and the G90-2MW IA. Both selected WTG models follow a conventional design approach using a pitch regulated three-bladed variable speed upwind WTG with active yaw.

The following table presents the technical summary of the WTGs:

Table 2. Technical Summary of the WTGs

Technical Summary	G87S-2 MW	G90-2 MW
Hub Height	78/ 90m	78/ 90m
Rotor Diameter	87 m	90 m
Rated Power	2,000 kW	2,000 kW
IEC Classification	S/IIA	A/IIA/IIIA
Cut-in Wind Speed	4 m/s	3m/s
Cut-out Wind Speed	25 m/s	25 m/s
Noise level	105 dB	105 dB
Generator	Doubly-fed Asynchronous controlled through IGBT converters and PWM (pulse width modulation) electronic control	Doubly Fed Asynchronous controlled through IGBT converters and PWM electronic control
Gearbox	Standard three stage (1 planetary / 2 x parallel stages)	Standard three stage (1 planetary / 2 x parallel stages)
Gearbox Ratio	1:127.2 (60 Hz)	1:120.5 (60 Hz)

Source: GAMESA

<u>The Project Instances will have the following characteristics:</u>

- **INSTANCE 1: Campos Azules 20 MW Wind Project.**

The Project will install nine (9) Gamesa G90-2MW with a hub height of 78m and one (1) Gamesa G87s-2MW with a hub height of 78m, with a nominal power per unit of 2,000 KW.

Table 3. Campos Azules Technical Specifications

Turbine Model	Gamesa G87s/G90 (2.0 MW) 87-m / 90-m Rotor Diameter Standard Weather Package
Rated Capacity	20 MW
Hub Height	78 m
Number of Turbines	10
Array-Average Free.-Stream Speed	11.69 m/s

Gross Annual Production	111.2 GWh/yr
Plan, Wake and Total Losses	Plant – 15.8% Wake – 0.2% Total – 16%
Net annual Production (Capacity Factor)	93.4 GWh/yr (53.3%)

Source: AWS Energy Production Report.

- **INSTANCE 2: Altamira 20 MW Wind Project.**

The Project will install ten (10) Gamesa G90-2MW with a hub height of 78m, with a nominal power per unit of 2,000 KW.

Table 4. Altamira Technical Specifications

Turbine Model	Gamesa G90 (2.0 MW) 90-m Rotor Diameter Standard Weather Package
Rated Capacity	20 MW
Hub Height	78 m
Number of Turbines	10
Array-Average Free.-Stream Speed	10.92 m/s
Gross Annual Production	100.6 GWh/yr
Plan, Wake and Total Losses	Plant – 13 % Wake –1.1 % Total – 13.9%
Net annual Production (Capacity Factor)	86.6 GWh/yr (49.4%)

Source: AWS Energy Production Report.

- **INSTANCE 3: Vientos de Miramar 20 MW Wind Project.**

The project will have five (5) Gamesa G87s-2MW with a hub height of 78m and five (5) Gamesa G87s-2MW with a hub height of 90m, with a nominal power per unit of 2,000 KW.

Table 5. Vientos de Miramar Technical Specifications

Turbine Model	Gamesa G87s (2.0 MW) 87-m Rotor Diameter Standard Weather Package
Rated Capacity	20 MW
Hub Height	78 m / 90 m
Number of Turbines	10
Array-Average Free.-Stream Speed	11.71 m/s
Gross Annual Production	120.3 GWh/yr
Plan, Wake and Total Losses	Plant – 14.1% Wake – 3.4 % Total – 17%
Net annual Production (Capacity Factor)	99.8 GWh/yr (56.9%)

Source: AWS Energy Production Report.

- **INSTANCE 4: Vientos de la Perla 20 MW Wind Project.**

The Project will consider ten (10) Gamesa G87s-2MW with a hub height of 78m, with a nominal power per unit of 2,000 KW.

Table 6. Vientos de la Perla Technical Specifications

Turbine Model	Gamesa G87s (2.0 MW) 87-m Rotor Diameter Standard Weather Package
Rated Capacity	20 MW
Hub Height	78 m
Number of Turbines	10
Array-Average Free.-Stream Speed	11.89 m/s
Gross Annual Production	121.4 GWh/yr
Plan, Wake and Total Losses	Plant – 14.5% Wake – 1.0 % Total – 15.3%
Net annual Production (Capacity Factor)	102.8 GWh/yr (58.6%)

Source: AWS Energy Production Report.

Table 7. Generation Summary of the Project INSTANCES

INSTANCE	Total Average annual generation
1. Campos Azules 20 MW Wind Project	93,431 MWh
2. Altamira 20 MW Wind Project	86,606 MWh
3. Vientos de Miramar 20 MW Wind Project	99,833 MWh
4. Vientos de la Perla 20 MW Wind Project	102,764 MWh
TOTAL	**382,634 MWh**

The project will result in technology transfer in terms of its construction and operation, as this type of renewable energy projects create local "know-how", knowledge and skills related to the installation and operation of the projects. Experience and training to local workers will be provided during construction, operation and maintenance of the projects.

Campos Azules and Altamira Projects will be connected to the Tejona 34.5 KV substation (metering point), owned by Instituto Costarricense de Electricidad (ICE; public utility) and La Perla and Miramar Projects will be connected to the Orosi substation, which is owned by Orosí Wind Farm SPV, property of IEDO and subsequently to Las Pailas substation (metering point), property of ICE.

The equipment to be installed at the project site is new and has an expected lifetime of 20 years[1].

Before the construction of each of the projects, no other projects or technologies for electricity generation were employed at each project site, hence the projects are Greenfield projects.

[1] As per IEC norm 61400-1 (2005) for class I to III wind turbines.

1.9 Project Location

The geographic boundary of the grouped project is the Republic of Costa Rica. The project instances are located in the Province of Guanacaste, at the Tilarán and Liberia Canton, as per the following table:

Table 8. Location of the project instances

INSTANCE	PROVINCE	CANTON	DISCRICT
1. Campos Azules 20 MW Wind Project	GUANACASTE	TILARAN	Santa Rosa
2. Altamira 20 MW Wind Project			
3. Vientos de Miramar 20 MW Wind Project		LIBERIA	Cañas Dulces and Mayorga
4. Vientos de la Perla 20 MW Wind Project			Mayorga

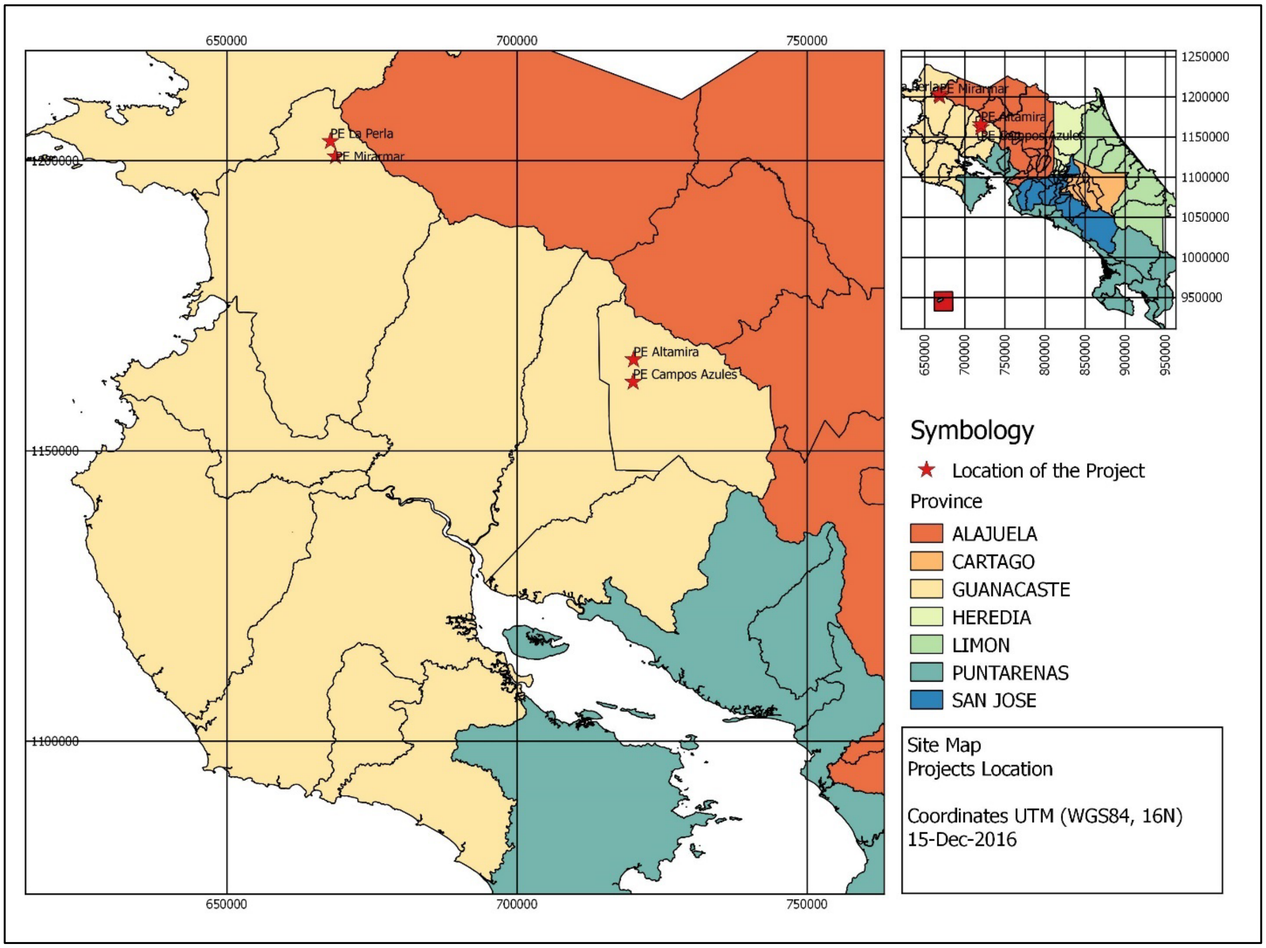

Figure 1. Location of the Project instances and Project Boundary

Table 9. UTM Geographic Coordinates of the projects

TILARÁN				LIBERIA		
ALTAMIRA PROJECT				**LA PERLA PROJECT**		
ALT 601	E720224	N1165345		P01	E667803	N1204272
ALT 602	E720182	N1165506		P02	E667774	N1204038
ALT 603	E720092	N1165638		P03	E668148	N1203780
ALT 604	E719944	N1165746		P04	E668020	N1203902
ALT 605	E719869	N1165891		P05	E667412	N1203465
ALT 606	E719802	N1166042		P06	E667487	N1203313
ALT 607	E720112	N1166446		P07	E667713	N1203225
ALT 608	E720097	N1166656		P08	E667859	N1203114
ALT 609	E720427	N1164029		P09	E667892	N1202880
ALT 610	E720233	N1163724		P10	E667968	N1202727
CAMPOS AZULES				**MIRAMAR PROJECT**		
CAZ 501	E719610	N1160792		M01	E667164	N1202679
CAZ 502	E719598	N1160539		M02	E667245	N1202520
CAZ 503	E719542	N1160337		M03	E667318	N1202376
CAZ 504	E719514	N1160129		M04	E667307	N1202187
CAZ 505	E719577	N1159948		M05	E667262	N1201987
CAZ 506	E719809	N1162159		M06	E668781	N1201126
CAZ 507	E719884	N1161998		M07	E668716	N1200900
CAZ 508	E719934	N1161827		M08	E668663	N1200678
CAZ 509	E719967	N1161651		M09	E668701	N1200497
CAZ 510	E719944	N1161428		M10	E668713	N1200290

1.10 Conditions Prior to Project Initiation

The grouped project is formed by newly installed power plants, and there were no project activities at the project sites before the construction of the proposed project activities. Hence, the baseline scenario is the same as the conditions existing prior to the project initiation, so please see section 2.4 (Baseline Scenario).

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Regulatory framework relevant for the proposed project involves the following set of norms[2]:

- *Ley No. 7593 (August 1996), "Law for the creation of the ruling authority of public services (ARESEP)" and Executive Decree No. 25,903 (February 1997):"Regulatory decree for Law No. 7593*". Article 9 of this law states that ARESEP is the entity responsible for issuing the generation licenses for private-owned power plants.
- *Ley No. 7200 (October 1990), as modified by Law No. 7508 (May 1995): "Law for autonomous (i.e. private) generation"*.
- Ley N° 7512, Law that established MINAE´s functions as the rector of the sector.

The Projects were conceived and developed within chapter I of the "Law 7200 and its amendments. Chapter one of the law allows for the installation by private sector generators of plants of up to 20 MW, as long as the overall capacity additions to the grid under this category do not collectively exceed 15% of the grid's total capacity. Likewise, 35% of the private generator's ownership structure must be owned by Costa Rican citizens/institutions.

Regulatory framework relevant for the proposed project activities involves the following set of permits, which have been already issued for the project instances:

- Concession for electricity generation granted by ARESEP (Service Public Regulatory Authority):
  - *Campos Azules Wind Project: Resolution RJD-042-2014, dated May 15, 2014*
  - *Altamira Wind Project: Resolution RJD-124-2014, dated October 23, 2014*
  - *Vientos de Miramar Wind Project: RJD-092-2014. Dated August 28, 2014*
  - *Vientos de La Perla Wind Project: RJD-094-2014, dated September 4, 2014*
- Environmental viability of the projects was granted through the following resolutions:
  - *Campos Azules Wind Project: Resolution No. 593-2014 SETENA, dated March 24, 2014*
  - *Altamira Wind Project: Resolution No. 1839-2014-SETENA, dated September 10, 2014*
  - *Vientos de Miramar Wind Project: Resolution No. 1036-2014-SETENA, dated May 30, 2014*

[2] 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. All the alternatives listed are in compliance with these norms.

- *Vientos de La Perla Wind Project: Resolution No. 1060-2014-SETENA, dated June 04, 2014*

All environmental and construction related approvals have been issued; hence the project complies with all relevant laws and regulatory framework.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

Alisios Holding, S.A. will be the managing company of the grouped project which has legal right to signed on behalf of the "Special Purpose Vehicles" (SPVs) developing the projects. Evidence is available to the DOE.

The SPVs are the Following*:*

INSTANCES	Project	Project developer (SPVs)
1	Campos Azules	INVERSIONES EÓLICAS CAMPOS AZULES, S.A.
2	Altamira	INVERSIONES EÓLICAS GUANACASTE, S.A.
3	Miramar	COSTA RICA ENERGY HOLDING, S.A.
4	La Perla	VIENTOS DEL VOLCAN, S.A.

Alisios Holding, S.A. hold the Project ownership of the Grouped Project as evidenced in accordance with item (3) of Section 3.11.1 of the VCS Standard v3.7. Alisios Holding, S.A. has full ownership (100%) of the companies developing the projects, hence has full ownership of the plants, equipment and process that generates the GHG emission reductions and have not divested of such ownership.

1.12.2 Emissions Trading Programs and Other Binding Limits

The grouped project does not (and will not) reduce GHG emissions from activities that are included in other emissions trading program or any other mechanism that includes GHG allowance trading.

1.12.3 Other Forms of Environmental Credit

The grouped project will not generate any other form of GHG-related environmental credits.

1.12.4 Participation under Other GHG Programs

The grouped project does not intend to participate in other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

The grouped project has not participated in other GHG Programs; hence, this section does not apply for the project.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

In the following all eligibility criteria are given:

1. *Each project activity instance under the grouped project is in accordance with the approved consolidated CDM baseline and monitoring methodology ACM0002 (Version 17.0.0) "Grid-connected electricity generation from renewable sources",* details showed in the section 2.2.

2. *Only grid connect wind power generation instance project is involved by the grouped project;*

3. *The geographic boundary of each instance lies within the geographic boundary set of the grouped project, and it is showed in section 2.3;*

4. *Additionality of the project activity shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionally", as per section 2.5.*

5. *The start date of each project activity instance under the grouped project should not be prior to the start date of the grouped project (*09/12/2016*). The start date of each project activity instance is determined as the date on which the project began generating GHG emission. The start date of each project activity instance will be determined through documentary evidence.*

6. *Each project activity instance under the grouped project is subject to the baseline scenario determined in the section 2.4*; details please refer to section 2.4.

Leakage Management

According to applied CDM methodology ACM0002 (Version 17.0.0), leakage is not considered.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

These projects will contribute to the sustainable development of Costa Rica by promoting wind power technology development in the host country. The renewable energy generated by the project will satisfy part of the growing electricity demand in the host country and the region.

Further Information

No further information is required.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Approved baseline and monitoring methodology applied:

- ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 17.0.0)

The following tools were applied together with the methodology:

- "Tool for the demonstration and assessment of Additionality" (Version 07.0.0)
- "Tool to calculate the emission factor for an electricity system" (Version 05.0.0)
- "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 02.0)

All documents available at:

http://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

2.2 Applicability of Methodology

Table 10. Applicability as per ACM0002

Description of applicability condition as per ACM0002 (version 17.0.0)	***Applicable ? Ye. s/no***	***Justification***
This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plant(s)/unit(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	Yes	a) The grouped project activity involves the installation of greenfield wind power plants.
The methodology is applicable under the following conditions: (a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between	Yes	a) The project type of the grouped project is wind power plants. b) The grouped project is not capacity additions, retrofits, rehabilitations or replacements type, thus the applicability is not relevant to the project.

the start of this minimum historical reference period and the implementation of the project activity.		
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs is lower than or equal to 4 W/m2, all of the following conditions shall apply: i. The power density calculated using the total installed capacity of the integrated project, is greater than 4 W/m2; ii. Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; iii. Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	Not applicable	The grouped project considers wind power plants.
In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	Not applicable	The grouped project considers wind power plants.
The methodology is not applicable to: (a) project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units.	Not applicable	The grouped project considers a wind power plants.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the	Not applicable	The grouped project is a greenfield power plant.

current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".		

Table 11. Applicability as per the Tool

Description of applicability condition as "Tool to calculate the emission factor for an electricity system" (Version 05.0.0)	***Applicable ? Yes/no***	***Justification***
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	Yes	The grouped project substitutes grid electricity (project activity supplies electricity to a grid).
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants.	Yes	Off-grid power plants are not included.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Not applicable	The grouped project is not located in an Annex I country.
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	Yes	A value of zero shall be applied for any biofuels (if required).

Therefore, based on the information above it is concluded that the methodology and the tool are applicable to the proposed project activity.

2.3 Project Boundary

According to the methodology, the project boundary "*includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to*" (ACM0002 paragraph 22). The electricity system is, in turn, defined by the tool for the calculation of the grid emission factor as the plants that are interconnected through transmission lines and "*that can be dispatched without significant transmission constraints*" (EB 87, Annex 9 paragraph 10.e). A unique national grid encompassing the whole territory exists in Costa Rica.

The following table reflects the greenhouse gases and emissions sources considered for baseline and project emissions as per the methodology:

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	As per ACM0002. Main emission source.
		CH_4	No	As per ACM0002.
		N_2O	No	As per ACM0002.
		Other	No	As per ACM0002.
Project	Grid Connected wind power based electricity generation	CO_2	No	No CO_2 emissions for wind power plants
		CH_4	No	No CH_4 emissions for wind power plants
		N_2O	No	No N_2O emissions for wind power plants

The project boundary is schematized in Figure 2 below; a map with the project's physical WTGs is provided in Figure 3 and Figure 4.

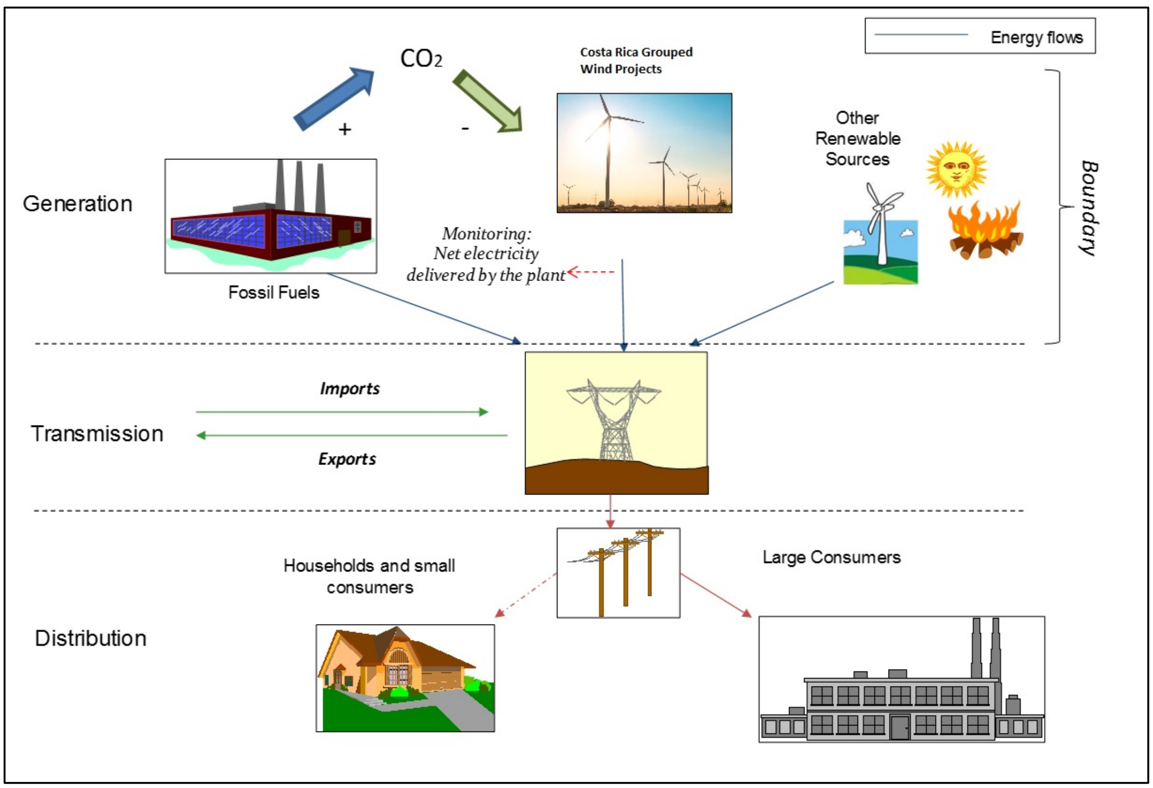

Figure 2. Project Boundary

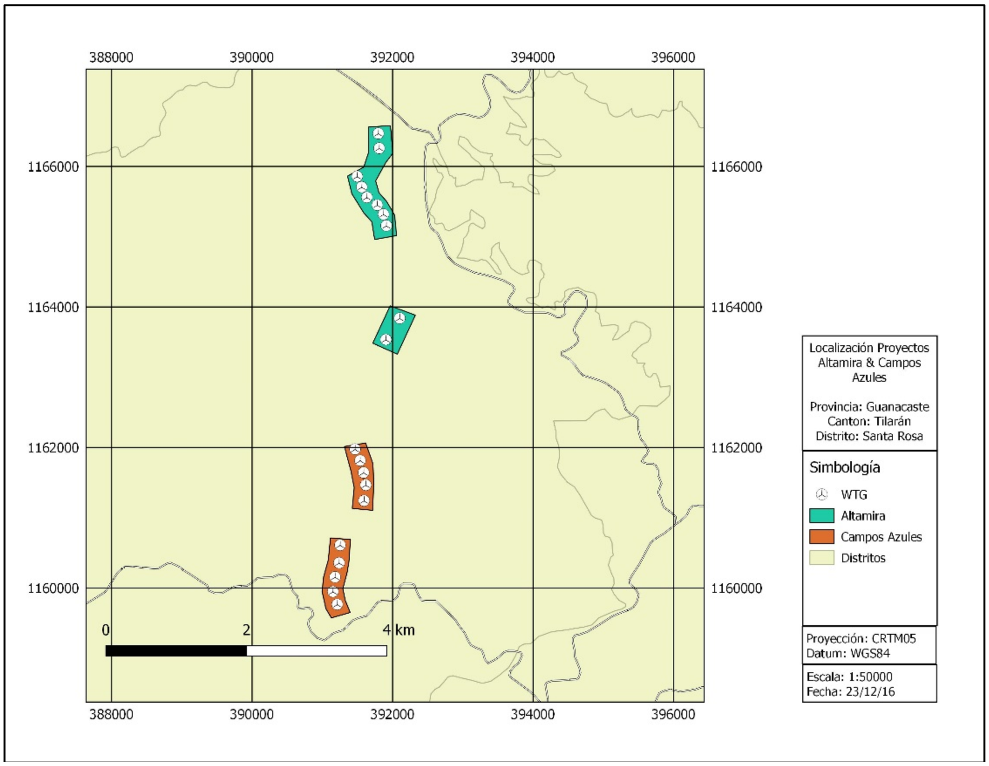

Figure 3. Location of the WTGs for Altamira and Campos Azules Projects

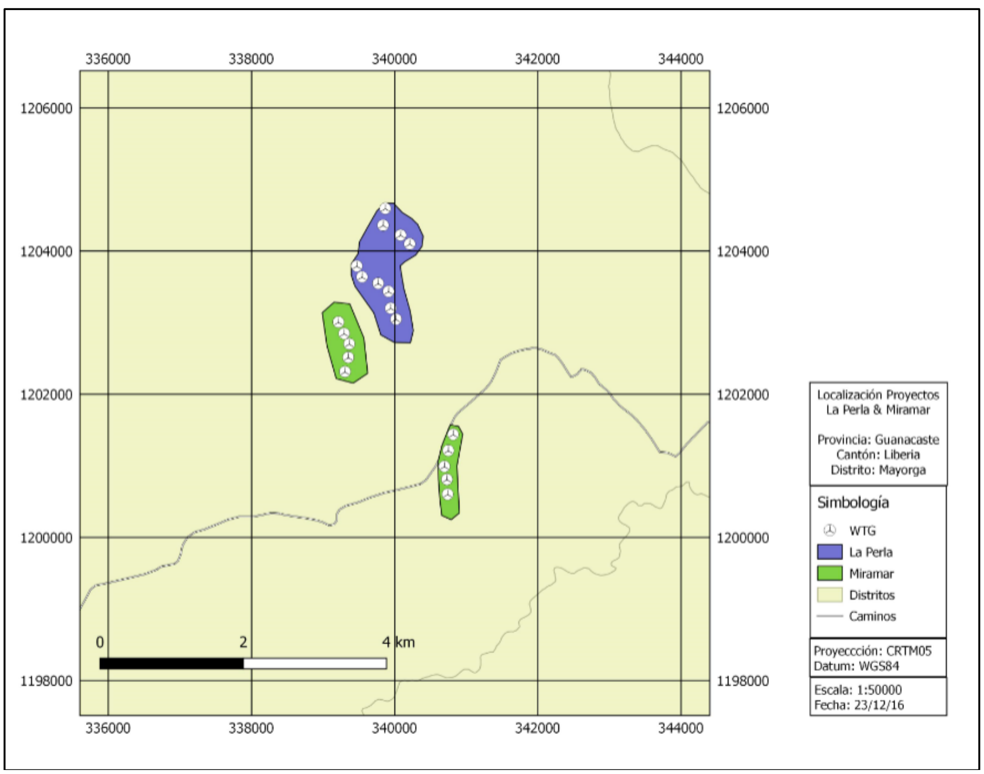

Figure 4. Location of the WTGs for La Perla and Miramar Projects

2.4 Baseline Scenario

According to the methodology, "*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´*" (Version 5.0.0).

In line with the previous definition, the baseline consists of a combination of i) other plants currently in the grid, and ii) new additions to the system; the grid emission factor "summarizes" both aspects in the combined margin emission factor, which is in turn a weighted average of an operation margin emission factor (capturing emissions from existing plants in the grid) and a build margin emission factor (which captures new additions to the grid by looking at the power plants most recently introduced) (EB 87, Annex 9). This quantitative characterization of the grid is provided in Section 3.1 below.

2.5 Additionality

This section is divided in two parts. The first subsection describes general procedures for the demonstration of additionality, i.e. the method applicable to every instance within this grouped project. The second part serves as a case-specific example, applying the general methods described in the first part to the four instances that are bound to be registered from the start of the grouped project.

Part A. Demonstration of additionality for instances within the grouped project.

ACM0002 ver. 17.0 allows two procedures for the demonstration of additionality. The first one considers a simplified method for projects within a positive list, in which on-shore power projects are not included[3]. Thus, only the second procedure will be used in the context of this grouped project as per section 5.3.2 in the methodology. Said method consists in the application of the "*Tool for the demonstration and assessment of additionality*", which also refers to the "*Methodological tool: Investment analysis*". All the instances shall consider version 7 of both afore mentioned documents, i.e. the latest available versions at the time of registration of the grouped project.

Figure 5 depicts the steps within the tool that are relevant in the context of this grouped project, namely, steps 1, 2, and 4. This is because first-of-its-kind criteria (step 0) do not apply to this activity since wind power projects already exist in Costa Rica. Likewise, barrier analysis (step 4) will not be considered to demonstrate additionality.

Part B below presents specific examples in which relevant laws and potential alternatives for the investment analysis are provided. However, both the applicable regulations and the relevant investment alternatives (both discussions encompassed within step 1 of the tool) shall be provided in the context of each instance and in accordance with the provisions included in the two tools. This

[3] See paragraph 30 in ACM0002 ver. 17.

will contribute towards a more transparent depiction of each of the power projects in terms of additionality and in keeping an up-to-date register of relevant/applicable legislation within the group.

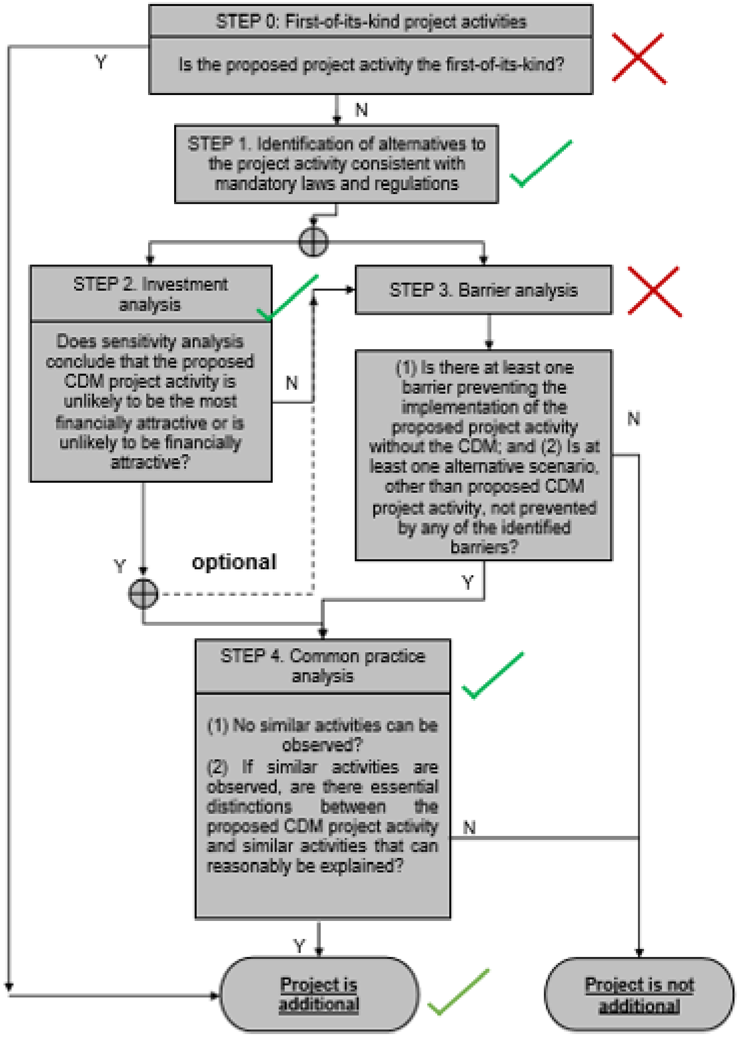

Figure 5. Relevant steps from the additionality tool (ticked in green)

Part B. Demonstration of additionality for the four initial instances.

As established in the general discussion on Part A, in order to demonstrate that the proposed project activity is not a part of the mentioned baseline scenario (i.e. to demonstrate that the project is additional), the "Tool for the demonstration and assessment of additionality" (EB 70, Annex 8) will be followed. This section includes all four instances that are submitted for registration with the grouped project PD, namely, Miramar, Altamira, Campos Azules and La Perla, each of 20 MW of nominal capacity, for a total of 80 MW.

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 regulation

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

In all four instances, the alternatives for the project developer are mainly:

a) To pursue the proposed project activity without carbon credits;

b) Cease to pursue the proposed instances, i.e. continuation of the current situation. This would imply that electricity would be generated by the operation of the rest of the grid-connected power plants and new capacity additions. This business-as-usual scenario implies that CO_2 emissions to the atmosphere would continue to be released at their present trend.

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

The main regulation applicable to renewable energy projects at the time of preparation of this document are Law No. 7200, which was issued in October 1990 (modified in May 1995) and that allows for private electricity generation.

The first alternative depicted on Sub-step 1a consists of the proposed project activity undertaken without being registered as a VCS project activity. In terms of Costa Rican regulations, this is the same as the proposed project in its present state, which has already proven compliance with all national regulations, as evidenced from the respective operation permits.

The second alternative in Sub-step 1a 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- follow all applicable legal and regulatory requirements.

None of the identified alternatives contravenes any legal or regulatory requirement, or poses a risk to do so in the future.

Step 2: Investment analysis.

The purpose of this section is to determine whether the proposed instances are not:

a. The most economically or financially attractive (compared to their respective alternatives); or

b. Economically or financially feasible, without the revenue from the sale of carbon credits.

As the relevant alternatives in the context of this project involve either to develop the respective projects without carbon revenues or not pursuing the projects at all, it will be demonstrated that each instance is not economically or financially feasible without VCS incentives. The analysis follows the “Guidance on the Assessment of Investment Analysis” (EB 85, Annex 12).

Sub-step 2a: *Determine appropriate analysis method*

The project activity generates financial and economic benefits other than carbon income, so a simple cost analysis (Option I) cannot be applied. The available alternatives as per EB 70, Annex 8 are investment comparison analysis (Option II) and benchmark analysis (Option III). An investment comparison analysis is suited for cases where 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. However, if the alternative to the project activity is whether to invest or not, a benchmark approach is appropriate. Hence, the additionality of this project will be demonstrated by means of Option III: Benchmark analysis.

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

The equity internal rate of return (equity IRR) is selected as this is the most common indicator for project appraisal. It is one of the main indicators used by all potential investors to evaluate economic feasibility of renewable energy projects, and as such constitutes the most suitable financial indicator in the context of additionality.

Equity IRR is an after-tax indicator that takes into account financial leverage. As per paragraph 16 on the "Methodological Tool: investment analysis", required/expected returns on equity are appropriate benchmarks for equity IRRs; therefore, this benchmark will be used. Furthermore, the Tool's appendix provides default benchmark values for the expected return on equity; for Costa Rica, said value is 11.52% (EB 85, Annex 12, p. 13). This default rate is provided on real terms (EB 85, Annex 12, p. 11), and therefore the latter needs to be converted to nominal terms by adding the inflation rate in accordance with the provisions in paragraph 17 of the Tool. As the main items in this project are expected to be nominated in US dollars (e.g. the price per MWh in the PPA), inflation for said currency will be used instead of that of the local Colon. According to the US Federal Reserve, the long-term forecast for this parameter is 2.00%.

The adjusted benchmark can be obtained from the following expression:

$$(1 + \mathrm{r}) \times (1 + \pi) = (1 + \mathrm{i}) \qquad (1)$$

r = Real benchmark rate
π = Inflation rate
i = Nominal benchmark rate

The resulting nominal benchmark is 13.75**%**.

Sub-step 2c: *Calculation and comparison of financial indicators (only applicable to Options II and III):*

General aspects

The financial model considered herein contains the latest information available on October 2015, when the EPC contract was subscribed. Main assumptions for the base scenario for each instance are provided below:

Table 12 – Miramar assumptions

Item	**Value and sources**
Expected generation & PLF (Source: AWS Truepower report)	99,833 MWh/yr (high season: 47,197 MWh; low season: 52,636 MWh); Net Capacity Factor = 56.98%.
Electricity price (Source: PPA)	High season: $110.06 / MWh. Low season: $44.07 / MWh.
Project lifetime (Source: IEC norm 61400-1 (2005) for class I to III wind turbines)	20 years. Any outstanding non-depreciated value is added as income in the last period.
Construction costs	$44,351,213.

(Source: Common Terms Agreement (CTA) with financing institutions)	
Annual O&M expenses (Source: Annual Operating Plan)	$2,081,000.
Loan conditions (Source: Common Terms Agreement (CTA) with financing institutions)	Equity: 20.6% Senior debt: 75.1% (@ 6.75% yearly interest) Subordinated debt: 4.2% (@ 10.04% yearly interest). Period: 17 years (+ 2 years grace period).

Table 13 – Altamira assumptions

Item	Value and sources
Expected generation & PLF (Source: AWS Truepower report)	86,606 MWh/yr (high season: 43,348 MWh; low season: 43,258 MWh); Net Capacity Factor = 49.43%.
Electricity price (Source: PPA)	High season: $110.06 / MWh. Low season: $44.07 / MWh.
Project lifetime (Source: IEC norm 61400-1 (2005) for class I to III wind turbines)	20 years. Any outstanding non-depreciated value is added as income in the last period.
Construction costs (Source: Common Terms Agreement (CTA) with financing institutions)	$41,214,249.
Annual O&M expenses (Source: Annual Operating Plan)	$2,488,700.
Loan conditions (Source: Common Terms Agreement (CTA) with financing institutions)	Equity: 20.6% Senior debt: 75.1% (@ 6.75% yearly interest) Subordinated debt: 4.2% (@ 10.04% yearly interest). Period: 17 years (+ 2 years grace period).

Table 14 – Campos Azules assumptions

Item	Value and sources
Expected generation & PLF (Source: AWS Truepower report)	93,431 MWh/yr (high season: 46,486 MWh; low season: 46,945 MWh); Net Capacity Factor = 53.33%.
Electricity price (Source: PPA)	High season: $110.06 / MWh. Low season: $44.07 / MWh.
Project lifetime (Source: IEC norm 61400-1 (2005) for class I to III wind turbines)	20 years. Any outstanding non-depreciated value is added as income in the last period.
Construction costs (Source: Common Terms Agreement (CTA) with financing institutions)	$40,745,162.
Annual O&M expenses (Source: Annual Operating Plan)	$2,517,500.
Loan conditions (Source: Common Terms Agreement (CTA) with financing institutions)	Equity: 20.6% Senior debt: 75.1% (@ 6.75% yearly interest)

	Subordinated debt: 4.2% (@ 10.04% yearly interest). Period: 17 years (+ 2 years grace period).

Table 15 – La Perla assumptions

Item	Value and sources
Expected generation & PLF (Source: AWS Truepower report)	102,764 MWh/yr (high season: 47,806 MWh; low season: 54,958 MWh); Net Capacity Factor = 58.66%.
Electricity price (Source: PPA)	High season: $110.06 / MWh. Low season: $44.07 / MWh.
Project lifetime (Source: IEC norm 61400-1 (2005) for class I to III wind turbines)	20 years. Any outstanding non-depreciated value is added as income in the last period.
Construction costs (Source: Common Terms Agreement (CTA) with financing institutions)	$53,440,737.
Annual O&M expenses (Source: Annual Operating Plan)	$2,592,000.
Loan conditions (Source: Common Terms Agreement (CTA) with financing institutions)	Equity: 20.6% Senior debt: 75.1% (@ 6.75% yearly interest) Subordinated debt: 4.2% (@ 10.04% yearly interest). Period: 17 years (+ 2 years grace period).

<u>Results from the base case</u>
The equity IRRs for each of the instances is presented on the table below. Note that each value is below the 13.75% benchmark. Therefore, the proposed project is additional to the baseline scenario.

Table 16 – Model results (base scenario)

Instance	IRR (benchmark = 13.75%)
Miramar	10.65%
Altamira	6.80%
Campos Azules	11.37%
La Perla	4.90%

Sub-step 2d: *Sensitivity analysis*

The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive.

According to paragraph 28 on EB 92, Annex 5, “only variables, including initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation". In addition, paragraph 29 states that "As a general point of departure variations in the sensitivity analysis should at least cover a range of +10% and -10%, unless this is not deemed appropriate in the context of the specific project circumstances". For these projects, the wind studies provide uncertainty levels for the generation estimates[4]; the default ±10% variation is applied to the rest of the parameters that are included in the analysis. The results are summarized in the tables below.

Table 17. IRR results for the sensitivity analysis (Miramar)

Instance: **Miramar**	**Low**	**Mid**	**High**
Benchmark (UNFCCC default)	13.75%	13.75%	13.75%
Revenues (± 5.7%)	7.22%	10.65%	13.93%
Investment costs (± 10%)	13.94%	10.65%	7.74%
O&M (± 10%)	12.80%	10.65%	8.41%
Interest payments (± 10%)[5]	11.98%	10.65%	9.37%

Table 18. IRR results for the sensitivity analysis (Altamira)

Instance: **Altamira**	**Low**	**Mid**	**High**
Benchmark (UNFCCC default)	13.75%	13.75%	13.75%
Revenues (± 4.8%)	3.63%	6.80%	9.61%
Investment costs (± 10%)	9.95%	6.80%	3.96%
O&M (± 10%)	9.23%	6.80%	4.06%
Interest payments (± 10%)[6]	8.10%	6.80%	5.44%

Table 19. IRR results for the sensitivity analysis (Campos Azules)

Instance: **Campos Azules**	**Low**	**Mid**	**High**
Benchmark (UNFCCC default)	13.75%	13.75%	13.75%
Revenues (± 4.8%)	8.37%	11.37%	14.24%
Investment costs (± 10%)	14.72%	11.37%	8.40%
O&M (± 10%)	13.67%	11.37%	8.95%
Interest payments (± 10%)[7]	12.71%	11.37%	10.07%

Table 20. IRR results for the sensitivity analysis (La Perla)

Instance: **La Perla**	**Low**	**Mid**	**High**
Benchmark (UNFCCC default)	13.75%	13.75%	13.75%
Revenues (± 5.3%)	1.68%	4.90%	7.79%
Investment costs (± 10%)	7.86%	4.90%	2.24%
O&M (± 10%)	7.00%	4.90%	2.61%
Interest payments (± 10%)	6.28%	4.90%	3.50%

[4] Available to the DOE upon request.
[5] Although interest payments do not reach 20% of project revenues for this specific instance, it is nonetheless included for comparison purposes.
[6] As per footnote 5, included for comparison purposes only.
[7] As per footnote 5, included for comparison purposes only.

The tables show that the benchmark is only surpassed in four out of the 36 analyzed scenarios (i.e. 9 scenarios for each instance), namely, for the Campos Azules project and the Miramar instances, upon an increase in electricity generation[8] or in case of a 10% reduction in investment costs.

Campos Azules and Miramar have net capacity factors of 53.33% and 56.98% (respectively), already among the largest in Central America. Using the CDM pipeline database[9], which compiles information on every CDM project in the world, it is straightforward to see that the net capacity factors in wind farms in Central America and the Caribbean range from 20.7% (Quilvio Cabrera Wind Farm Project in Dominican Republic) to 49.4% (Orosí Wind Power Project in Costa Rica). Hence, a 4.8% increase in generation for Campos Azules and a 5.7% increase for Miramar would imply a net capacity factor of almost 56% and 60%, respectively, among the largest in the world. Moreover, the same data base allows a quick comparison in terms of expected versus actual performance of wind projects. Up to December 2016, the average issuance success rate for this technology was 84% at a world-wide level, indicating that generation has been almost 16% *less* than expected. Considering Central America, together with the Caribbean and Mexico, the average issuance success rate has been 88%, again suggesting *against* a permanent increase in actual generation compared to the ex-ante estimate. Likewise, an investor assessing the potential "gains" (i.e. 49 basis points *above* the benchmark for Campos Azules, and 18 basis points for Miramar) should also consider the potential "losses", which are (respectively) 538 and 653 basis points *below* the 13.75% threshold in case the projects underperform by the same magnitude. Given this asymmetry, and considering historical performances of wind farms at a global and a regional level, it is deemed extremely unlikely that an investor would find this prospect "attractive".

A similar conclusion can be derived in terms of the investment costs. Contingent costs allowances are $1,210,107 (Campos Azules) and $1,328,669 (Miramar), whereas the rest of the items in the budget[10] will already be either fixed or executed by the time the project reaches validation. Even if contingent costs are set to zero, investment costs would not decrease by 10% of their current estimate. Using the financial model, it is simple to verify that even after excluding contingent costs entirely, the equity IRR does not reach the benchmark[11].

In conclusion, the sensitivity analysis conducted above confirms that the proposed project activity is not financially attractive and that its successful implementation requires VCS registration, i.e. that the proposed project activity is considered additional under Step 2 of the additionality tool.

Step 3: Barrier analysis

This optional step is not being applied in the context of this project.

[8] Revenues can only increase as a response to an increase in energy generation, as the prices are already fixed as per the PPA.
[9] UNEP DTU CDM/JI Pipeline Analysis and Database, available at http://www.cdmpipeline.org/ (Updated: December 1st, 2016).
[10] Detailed budget is available to the DOE.
[11] Exclusion of contingent costs results in a total CAPEX estimate of $39,535,055, which in turn results in a 12.59% IRR for Campos Azules; for Miramar, the values are $43,022,544 (CAPEX) and 11.86% (TIR).

Step 4: Common practice analysis

This analysis follows EB 84, Annex 7, which is in turn divided into a series of steps:

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

For all four instance in this grouped project (20 MW each), the applicable range is 10 – 30 MW.

Common practice step 2: Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

a) The projects are located in the applicable geographical area;

b) The projects apply the same measure as the proposed project activity;

c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity. As this is a VCS project, latest information available has been used instead.

Power plants falling within the same capacity range as the proposed project, as well as their characteristics, are listed in the table below:

Table 21. Plants within the +/- 50 % capacity range implementing the same measure (i.e. renewable energies). *Source:* Author's estimates based on ARESEP data

Plant name	Capacity (kW)	Technology	Carbon market?
Ventanas	10,000	Hydro	
Miravalles Iii	27,500	Geothermal	
Platanar	15,000	Hydro	
Aguas Zarcas	13,100	Hydro	
Don Pedro	14,000	Hydro	
Río Lajas	10,000	Hydro	
Volcán 3x	17,000	Hydro	
Doña Julia	16,000	Hydro	
El Viejo	18,000	Biomass	
Taboga	16,000	Biomass	

Tilarán (Pesa)	19,800	Wind	Yes (CDM #4147)
Tierras Morenas (Movasa)	20,000	Wind	
Miravalles V	21,000	Geothermal	
Tejona	19,800	Wind	Yes (CDM #0824)
Toro I	23,205	Hydro	
Toro III (Ice)	24,000	Hydro	
Toro III (Jasec)	24,000	Hydro	
Belén	10,502	Hydro	
Brasil	27,000	Hydro	
Daniel Gutiérrez	21,000	Hydro	
P.E Valle Central	15,300	Wind	Yes (CDM #8469)
Los Santos	12,750	Wind	Yes (CDM #6275)
BIRRÍS (1A, 1B, 2 Y 3)	24,420	Hydro	
Los Negros	17,000	Hydro	
Canalete	17,500	Hydro	
Central Sigifredo Solís S	26,000	Hydro	
San Lorenzo	15,000	Hydro	
Chocosuelas	26,000	Hydro	
Cubujuquí	21,600	Hydro	
Tilawind	21,000	Wind	

Common practice step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all}.

In our case, $N_{all} = 27$.

Common practice step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{dif}.

In our case, $N_{dif} = 24$, as the table shows that the majority of the projects are using technologies different to wind.

Common practice step 5: Calculate factor $F=1\text{-}N_{diff}./N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

In all four instances, $F = 0.11$.

As per EB 84, Annex 7, a proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:

1. The factor F is greater than 0.2; and
2. $N_{all}\text{-}N_{diff}$. is greater than 3.

As none of these conditions are true in the context of the proposed project instances, we may conclude that the latter are not a common practice and hence, they comply with the additionality criteria.

2.6 Methodology Deviations

Not Applicable

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

In general terms, emission reductions are given by:

$$ER_y = BE_y - PE_y - LE_y \quad (2)$$

where:

ER_y	=	Emission reductions in period y (tCO_2e/yr)
BE_y	=	Baseline emissions in period y (tCO_2e/yr)
PE_y	=	Project emissions in period y (tCO_2e/yr)
LE_y	=	Leakage emissions in period y (tCO_2e/yr)

As both project emissions (PE_y) and leakage emissions (LE_y) are zero for wind projects (EB 89, Annex 1, paragraph 36), baseline emissions (BE_y) will determine the amount of emission reductions (ER_y) attributable to the project activity.

3.1 Baseline Emissions

Baseline emissions include CO_2 emissions from electricity generation originated in fossil-fuelled power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as:

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad (3)$$

where:

BE_y	=	Baseline emissions in period y (tCO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in period y (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in period y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

For the specific case of greenfield projects, the methodology uses the notation $EG_{PJ,y} = EG_{facility,y}$, i.e. quantity of net electricity generation supplied by the project plant to the grid in period y.

The combined margin emission factor consists of a weighted average between two emission factors: the "operating margin" (which focuses on existing fossil fuelled plants affected by the project) and the "build margin" (which aims to capture the project's effect on the incorporation of new plants to the grid).

The *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9) applies six steps for the calculation of $EF_{grid,CM,y}$:

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. As described earlier in this document, in Costa Rica the relevant electric power system for the project is the National Interconnected System ("NIS"), the only grid in the country.

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.

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

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 Costa Rica, low cost/must-run (LC/MR) resources are comprised solely by renewable energies, and the latter constitute more than 50% of the total grid generation for each of the last five years with published data[12]. Likewise, the load by LC/MR resources is larger than each of the lowest annual system loads (LASL) in the last three years[13]:

Table 22. Loads by LC/MR resources

year (y)	EG_{LCMRy} (MWh)	$EG_{LCMRy}/8760$ (MW)	$LASLy$ (MW)
2013	8,888,587	1015	630
2014	9,025,781	1030	604
2015	10,668,750	1218	593

As the hourly loads of the grid (in MW) are also readily available, option (b) (Simple adjusted OM) will be used in the context of this project activity (EB 87, Annex 9, paragraph 36).

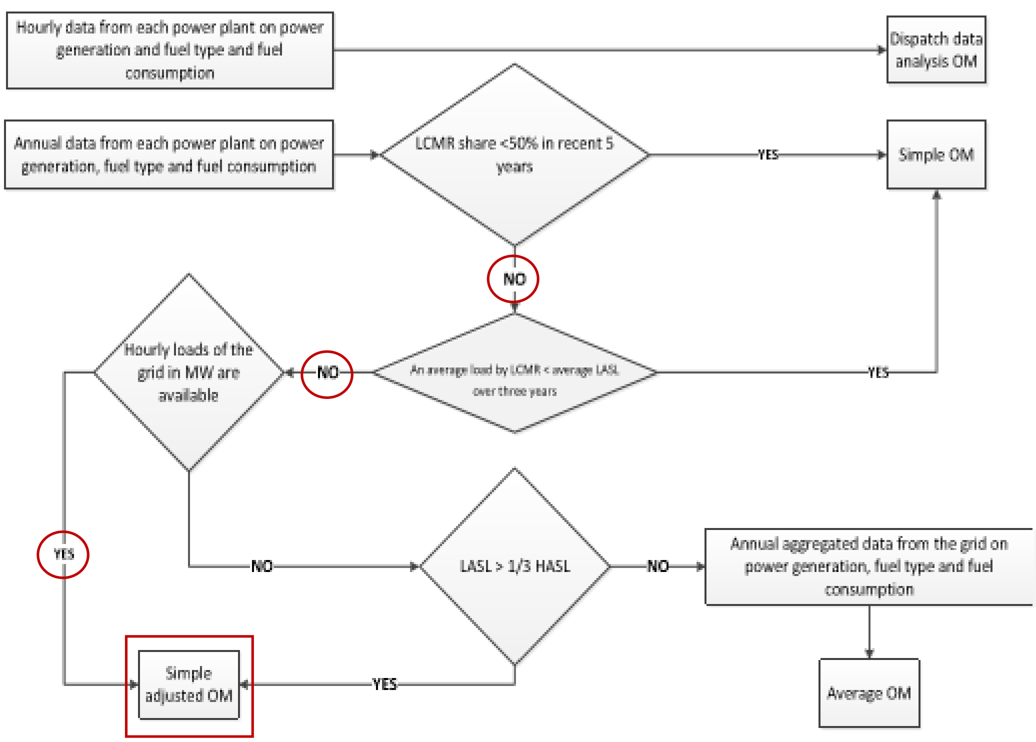

Figure 6. Selection of OM method

[12] "Electricity production statistics from SICA countries" (United Nations Economic Commission for Latin America and the Caribbean, 2016, p. 29). Spanish version of the document is available on the following link.

[13] See the emission factor spreadsheet where the lambdas coefficients are obtained (namely, the tabs "lambda2013", "lambda2014" and "lambda2015"). The area filled with LC/MR resources is always larger than the rectangle representing the LASL (this can be assessed from the load duration curves presented below in this section).

Finally, the data vintage chosen for the estimation of the simple OM is the ex-ante option, 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 (EB 87, Annex 9, paragraph 39 (a)). Available data from national statistics goes from 2013 to 2015; therefore, such is the data vintage chosen as requested by paragraph 41 of the tool.

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

The simple adjusted operating margin emission factor ($EF_{grid,OM\text{-}adj,y}$) is calculated based on the net electricity generation and an emission factor for each power unit (option A in EB 87, Annex 9, paragraph 44), as follows:

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

where:

$EF_{grid,OM\text{-}adj,y}$	=	Simple adjusted operating margin CO_2 emission factor in year y (tCO_2/MWh)
λ_y	=	Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EG_{k,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{EL,k,y}$	=	CO_2 emission factor of power unit k in year y (tCO_2/MWh)
m	=	All power units serving the grid in year y, except low-cost/must-run power units
k	=	All low-cost/must run grid power units serving the grid in year y
y	=	The relevant year as per the data vintage chosen in Step 3

As in Costa Rica the k group encompasses renewable energies only, $EF_{EL,k,y}$ = 0 for every plant in the set, thus rendering the entire second term on the right side of equation (4) above equal to zero. The λ_y coefficients can be calculated as per the procedure described in Appendix 4 of the emission factor tool. The following figure summarizes the procedures used for the calculation:

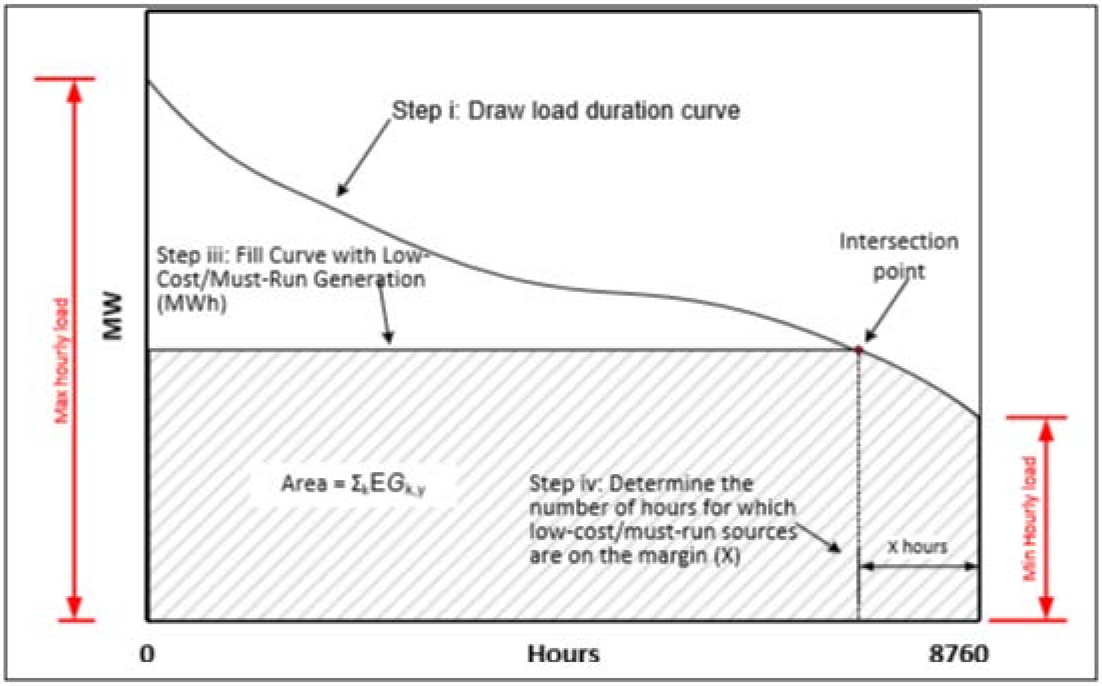

Figure 7. Steps for calculating the λ_y coefficients as per Appendix 4 of the tool (λ_y = x/8760)

For Costa Rica, the figures below provide the lambda values. The intersection point in the LC/MR curve must be set at the exact point where the area under the curve is equal to the total generation provided by LC/MR sources according to the national statistics. If the intersection point was set more to the right, the area under the blue curve would be less than the annual generation by LC/MR resources; whereas if the point was set more to the left, the area under the blue curve would be higher than the annual generation of LC/MR resources. Note also that to the left of the intersection point, the LC/MR curve is simply constant (i.e. flat) and that to the right, the LC/MR curve is equal to the load duration curve of the entire system. This behavior is modelled in Excel and the Solver function is simply set to find the constant that makes the area of the curve equal to the generation of LC/MR resources as per national statistics (detailed calculations provided in the spreadsheet):

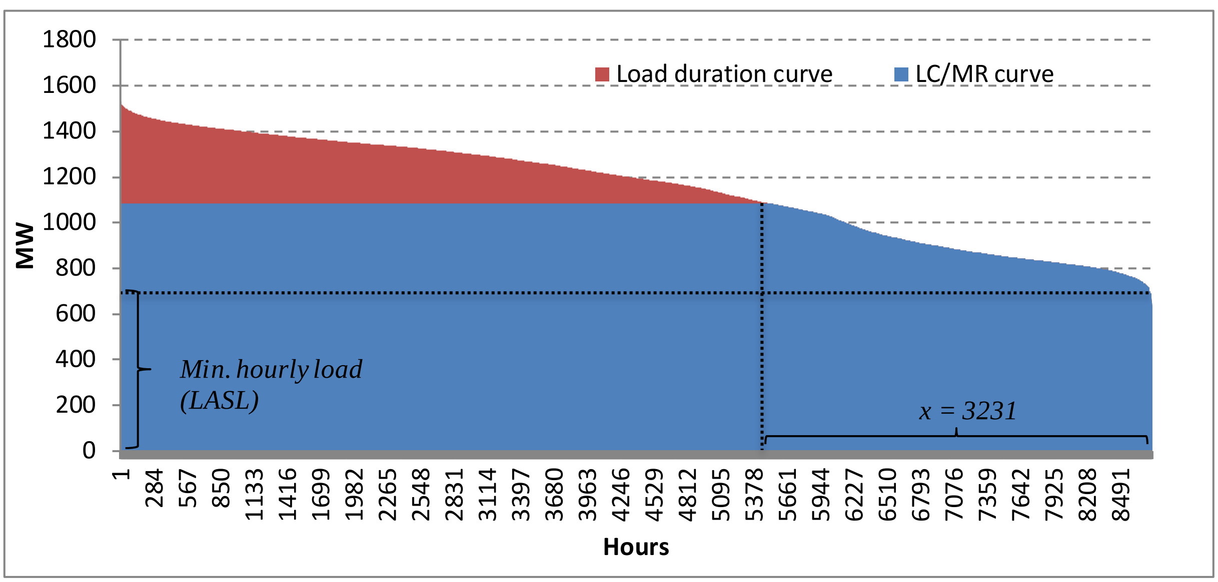

Figure 8. Load duration curve for 2013 (λ_{2013} = *0.3688*)

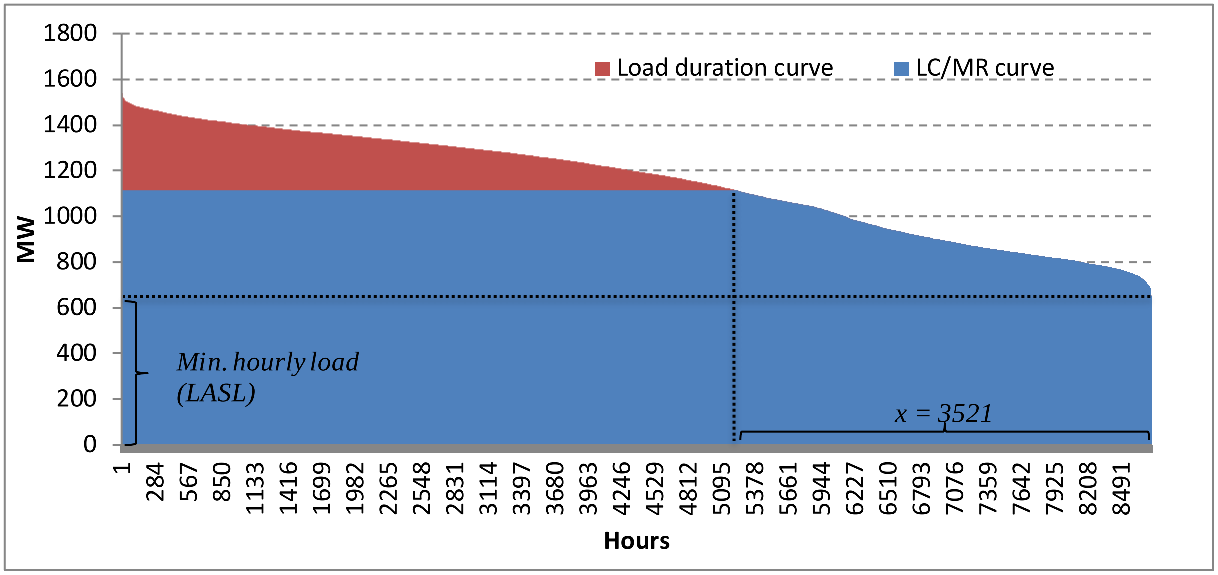

Figure 9. Load duration curve for 2014 ($\lambda_{2014} = 0.4019$)

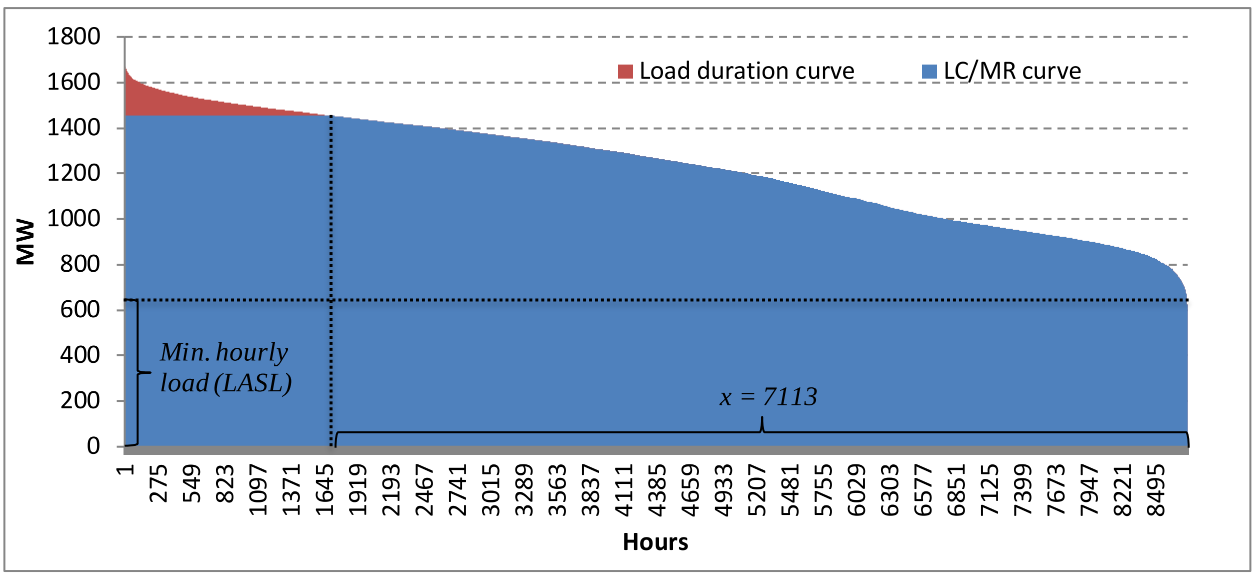

Figure 10. Load duration curve for 2015 ($\lambda_{2015} = 0.8120$)

As fuel consumption data is available, $EF_{EL,\,m,y}$ is obtained using option A1 in the methodology:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad (5)$$

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 fuel type i consumed by power unit m in year y (mass or volume unit)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$NCV_{i,y}$	=	Net calorific value (energy content) of fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel type i in year y (tCO_2/GJ)
m	=	All power units serving the grid in year y, except low-cost/must-run power units
i	=	All fuel types combusted in power unit m in year y
y	=	The relevant year as per the data vintage chosen in Step 3

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.

As per the tool, the sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above[14]:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh); according to the latest information available in Costa Rica (reproduced in the tables in the "CR_BM" tab of the EF spreadsheet), the last five non-CDM power units to enter the grid were Vientos del Este, Tilawind, Balsa Inferior, Tacares, and Cubujuquí. Their overall generation was $AEG_{SET\text{-}5\text{-}units} = 314{,}828$ MWh (cell H58 on the "CR_BM" tab).

[14] All the steps may be replied in the EF spreadsheet attached to this document (see the "BM" tab).

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh; in Costa Rica, in 2015: AEG_{total} = 9,236,152 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} ($SET_{\geq 20\%}$ - if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) and determine their annual electricity generation ($AEG_{SET \geq 20\%}$, in MWh); in our data, this set goes from Vientos del Este (commissioned in 2015) to Pirrís (commissioned in 2011), with $AEG_{SET \geq 20\%}$ = 1,961,862 MWh (cell H68 on the "CR_BM" tab).

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample}); thus, according to national 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 ago, then use SET_{sample} to calculate the build margin. In our case, the eldest unit in the set (Pirrís) was commissioned in 2011, which is less than 10 years ago and thus $SETsample$ will be used to calculate the BM. In this case, steps (d) through (f) in the tool can be ignored.

The build margin emission factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available (in our set, 2014), calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (6)$$

where:

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

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

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

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times \omega_{OM} + EF_{grid,BM,y} \times \omega_{BM} \qquad (7)$$

where:

$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

ω_{OM} = Weight (operating margin)

ω_{BM} = Weight (build margin)

y = Year at which the grid combined margin emission factor is being calculated

ω_{OM} and ω_{BM} are the weights given respectively to the operating margin emission factor and the build margin emission factor (i.e. $\omega_{OM} + \omega_{BM} = 1$). For wind projects, $\omega_{OM} = 0.75$ *and* $\omega_{BM} = 0.25$ are the default values for the first crediting period and are thus used in the context of this project activity.

3.2 Project Emissions

There are no project emissions from wind power plants.

3.3 Leakage

There are no leakage emissions from wind power plants.

3.4 Net GHG Emission Reductions and Removals

The emission factor will remain fixed throughout the first crediting period (i.e. $EF_{grid,CM,y} = EF_{grid,CM}$). As stated on the previous section, the operating margin is calculated for the last three years with available data, from which a generation-weighted average is obtained; thus, $EF_{grid,OM\text{-}adj,y} = EF_{grid,OM\text{-}adj,2013\text{-}2015}$. The build margin operating factor $EF_{grid,BM,2015}$ was calculated on an analogous manner as each yearly operating margin emission factor, but considering the set of plants described in section 3.1 (step 5).

A summary of the main results is reproduced in the table below; detailed calculations are available on the adjoining spreadsheet.

Table 23. Operating margin, build margin and combined margin emission factor

Factor	tCO_2/MWh	Grid generation (GWh)	Weight
$EF_{grid,OM\text{-}adj.,2013}$	0.4295	10,187	0.3277
$EF_{grid,OM\text{-}adj.,2014}$	0.4197	10,311	0.3317
$EF_{grid,OM\text{-}adj.,2015}$	0.1266	10,584	0.3405
$EF_{grid,OM\text{-}adj.,2013\text{-}2015}$	**0.3231**	31,081	0.75 (ω_{OM})
$EF_{grid,BM,2015}$	**0.0000**	1,962	0.25 (ω_{BM})
$EF_{grid,CM,}$	**0.2423**	**n.a.**	**n.a.**

Source: Author's calculation based on ARESEP data. *Note*: Weights for each $EF_{grid,OM\text{-}adj,y}$ are used to estimate the generation-weighted $EF_{grid,OM\text{-}adj,2013\text{-}2015}$; ω_{OM} and ω_{BM} are used to calculate $EF_{grid,CM}$.

Considering that $PE_y = LE_y = 0$, we may directly rewrite equation (2) as:

$$ER_y = EG_{facility,y} \cdot EF_{grid,CM} \tag{8}$$

This last expression shall ultimately be used in actual emission reduction measurements. The parameter $EG_{facility,y}$ will be monitored as described in the monitoring section, whereas the emission factor will remain fixed throughout the entire length of the first crediting period.

For ex-ante calculation purposes, expected generation will be assumed to be given by the following table:

Table 24. Expected yearly generation for each instance.

Facility	$EG_{facility,y}$ (MWh/yr)
Altamira	86,606
Campos Azules	93,431
La Perla	102,764
Miramar	99,833
Total	**382,634**

Thus, globally yearly emission reductions are expected to be ER_y = 382,634 MWh/yr × 0.2423 tCO_2/MWh = 92,710 tCO_2/yr. Detailed emission reductions for each instance are provided below.

Table 25. Expected ERs from the Altamira Wind Project.

Year	**Estimated baseline emissions or removals (tCO2e)**	**Estimated project emissions or removals (tCO2e)**	**Estimated leakage emissions (tCO2e)**	**Estimated net GHG emission reductions or removals (tCO2e)**
Year 1	20,984	0	0	20,984
Year 2	20,984	0	0	20,984
Year 3	20,984	0	0	20,984
Year 4	20,984	0	0	20,984
Year 5	20,984	0	0	20,984
Year 6	20,984	0	0	20,984
Year 7	20,984	0	0	20,984
Year 8	20,984	0	0	20,984
Year 9	20,984	0	0	20,984
Year 10	20,984	0	0	20,984
Total	209,840	0	0	209,840

Table 26. Expected ERs from the Campos Azules Wind Project.

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
Year 1	22,638	0	0	22,638
Year 2	22,638	0	0	22,638
Year 3	22,638	0	0	22,638
Year 4	22,638	0	0	22,638
Year 5	22,638	0	0	22,638
Year 6	22,638	0	0	22,638
Year 7	22,638	0	0	22,638
Year 8	22,638	0	0	22,638
Year 9	22,638	0	0	22,638
Year 10	22,638	0	0	22,638
Total	226,380	0	0	226,380

Table 27. Expected ERs from the La Perla Wind Project.

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
Year 1	24,899	0	0	24,899
Year 2	24,899	0	0	24,899
Year 3	24,899	0	0	24,899
Year 4	24,899	0	0	24,899
Year 5	24,899	0	0	24,899
Year 6	24,899	0	0	24,899
Year 7	24,899	0	0	24,899
Year 8	24,899	0	0	24,899
Year 9	24,899	0	0	24,899
Year 10	24,899	0	0	24,899
Total	**317,027**	**0**	**0**	**317,027**

Table 28. Expected ERs from the Miramar Wind Project.

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
Year 1	24,189	0	0	24,189
Year 2	24,189	0	0	24,189
Year 3	24,189	0	0	24,189
Year 4	24,189	0	0	24,189
Year 5	24,189	0	0	24,189
Year 6	24,189	0	0	24,189
Year 7	24,189	0	0	24,189
Year 8	24,189	0	0	24,189
Year 9	24,189	0	0	24,189
Year 10	24,189	0	0	24,189
Total	241,890	0	0	241,890

Table 29. Expected ERs from the grouped project.

Year	Estimated baseline emissions or removals (tCO2e)	Estimated project emissions or removals (tCO2e)	Estimated leakage emissions (tCO2e)	Estimated net GHG emission reductions or removals (tCO2e)
Year 1	92,710	0	0	92,710
Year 2	92,710	0	0	92,710
Year 3	92,710	0	0	92,710
Year 4	92,710	0	0	92,710
Year 5	92,710	0	0	92,710
Year 6	92,710	0	0	92,710
Year 7	92,710	0	0	92,710
Year 8	92,710	0	0	92,710
Year 9	92,710	0	0	92,710
Year 10	92,710	0	0	92,710
Total	927,100	0	0	927,100

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year y (last three years with available data were used).
Source of data	Calculations based on data provided by ARESEP for 2013-2015.
Value applied:	0.2423
Justification of choice of data or description of measurement methods and procedures applied	The parameter is calculated as the combined margin (CM) according to the "Tool to calculate the emission factor for an electricity system (version 05.0)".
Purpose of Data	Calculation of baseline emissions
Comments	For operating margin (OM) and built margin (BM) the respective ex-ante approaches are chosen.

Data / Parameter	**$EF_{grid,OM,y}$**
Data unit	tCO_2/MWh
Description	Operating Margin emission factor in year y (last three years with available data were used).
Source of data	Calculations based on data provided by ARESEP for years 2013-2015 and best practice assumptions.
Value applied:	0.3231
Justification of choice of data or description of measurement methods and procedures applied	The parameter is calculated according to the "Tool to calculate the emission factor for an electricity system (version 05.0)", as explained in the precious section.
Purpose of Data	Calculation of baseline emissions
Comments	All relevant data and parameters are based on data from ENEE.

Data / Parameter	**$EF_{grid,BM,y}$**
Data unit	tCO2/MWh
Description	Build Margin CO2 emission factor for the project electricity system in year y (2015 was considered in the context of this project).
Source of data	Calculations based on data provided by ARESEP for year 2015 and best practice assumptions.
Value applied:	0.0000
Justification of choice of data or description of measurement methods and procedures applied	The parameter is calculated according to the "Tool to calculate the emission factor for an electricity system (version 05.0)", as explained in the precious section.
Purpose of Data	Calculation of baseline emissions
Comments	All relevant data and parameters are based on data from ARESEP.

Data / Parameter	***$EG_{m,y}$***
Data unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit m in year y
Source of data	ARESEP
Value applied:	Data for the 2013-2015 period is available on the emission factor spreadsheet.
Justification of choice of data or description of measurement methods and procedures applied	Data is obtained from official sources.
Purpose of Data	Calculation of baseline emissions
Comments	

Data / Parameter	***$FC_{i,m,y}$***
Data unit	mass or volume unit
Description	Amount of fuel type i consumed by power unit m in year y
Source of data	ARESEP
Value applied:	Data for the 2013-2015 period is available on the emission factor spreadsheet.
Justification of choice of data or description of measurement methods and procedures applied	Data is obtained from official sources.
Purpose of Data	Calculation of baseline emissions
Comments	

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Data unit</td><td>GJ/mass or volume unit</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) of fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>ICE, "factores para el cálculo de emisiones de gases de efecto Invernadero del Sistema Eléctrico Nacional y su aplicación a un inventario del año 2010", page 21.</td></tr>
<tr><td>Value applied:</td><td><table><tr><td>Fuel oil</td><td>0.039354</td><td>TJ / 10^3 lts</td></tr><tr><td>Diesel</td><td>0.036462</td><td>TJ / 10^3 lts</td></tr></table></td></tr>
<tr><td>Justification of choice of data or description of measurement methods and procedures applied</td><td>Data from the main entity in the electricity sub-sector in Costa Rica.</td></tr>
<tr><td>Purpose of Data</td><td>Calculation of baseline emissions.</td></tr>
<tr><td>Comments</td><td>Notice that the original fuel consumption data provided by the facilities is expressed in volume units. The values are converted to mass units using the following density values:</td></tr>
</table>

	<table><tr><td>Fuel oil</td><td>0.9634</td><td>kg/lt</td></tr><tr><td>Diesel</td><td>0.8439</td><td>kg/lt</td></tr></table> This is sourced from the Energy Statistics Manual (IEA, 2004, p. 181).

Data / Parameter	***$EF_{CO2,i,y}$***
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fuel type *i* in year
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories (IPCC, 2006).
Value applied:	<table><tr><td>Fuel oil</td><td>75.5</td><td>tCO_2/TJ</td></tr><tr><td>Diesel</td><td>72.6</td><td>tCO_2/TJ</td></tr></table>
Justification of choice of data or description of measurement methods and procedures applied	No other data is publicly available. IPCC guidelines have been used in a conservative manner.
Purpose of Data	Calculation of baseline emissions
Comments	

4.2 Data and Parameters Monitored

1. **INSTANCE 1: Campos Azules 20 MW Wind Project and INSTANCE 2: Altamira 20 Wind Project**

Data / Parameter	***$EG_{facility,y}$***
Data unit	MWh
Description	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year *y* (MWh/yr)
Source of data	Electricity meter reading.
Description of measurement methods and procedures to be applied	Two bidirectional meters will be installed at the Metering Point (Tejona Substation), a main meter and a back-up meter. The bidirectional meters will measure both electricity generated that is being exported to the grid and discount electricity that is consumed by the project (imports). The quantity of net electricity supplied to the grid by the proposed project activity will be measured by the main meter at the project site recording both export electricity to the grid and import electricity from the grid. The data will be read

	primarily from the main meter. If an anomaly is detected in the data of the main meter, the data of the back-up meter will be used instead. The metering arrangements and the required quality control procedures to ensure accuracy are defined within the PPA between each Project and ICE.
Frequency of monitoring/recording	Monthly basis, recording continuously.
Value applied:	86,606 + 93,431 = 180,037 MWh/year (Altamira and Campos Azules instances respectively)
Monitoring equipment	Two bidirectional meters, a main meter and a back-up meter, will be installed at the Metering Point. The meters shall be advanced electronic socket meters, with an error no greater than 0.2 per cent (0.2%), with remote and real time communication facilities. Further details of the monitoring equipment is explained in the PPA page 24 and 85.
QA/QC procedures to be applied	Meter readings will be checked for completeness on a monthly basis and cross checked with the sales invoices. Verification of the meters will be done according to the PPA, every two years.
Purpose of data	Calculation of baseline emissions
Calculation method	The data/parameter will be read directly from the meters.
Comments	Data will be archived by means of electronic and paper backup for the full crediting period, plus two year years after the end of the Crediting period or the last issuance of CERs, whichever occurs later.

2. INSTANCE 3: Vientos de Miramar Wind Project and INSTANCE 4: Vientos de la Perla Wind Project

Data / Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the VCS project activity in year y (MWh/yr)
Source of data	Project activity site
Description of measurement methods and procedures to be applied	Vientos de Miramar and Vientos de la Perla will share the transmission line with each other and other projects. Generation is first delivered to the Orosí substation, where the apportioning is made, after which the electricity is delivered to the final metering

	point at the Las Pailas Substation. Due to that, the procedure to measure the net energy is the following: • Each Project instance will have two bidirectional meters (main and backup) (described respectively as $M_{VM\ and}$ M_{VP}) installed at the Orosí Substation (high voltage bus). These are used to measure gross electricity generated by each project instance. • A third pair of meters (main and back+up) (described as M_T) will be installed also in the Orosi Substation that will measure the total incoming energy from all the plants delivering to the substation. The Metering Point used for billing purposes will be located in Las Pailas Substation (ST Las Pailas), property of ICE, where another pair of meters, main and a back-up will be installed (M_{STP}). These meters will measure the total net energy coming from the Orosi Substation. The energy loses in the transmission line between the two substations will be distributed proportionally according to the energy delivered by each power plant as measured at the Orosi substation. The following equation shows how the delivered energy of each Project instance will be determined in a common period: $EG_{facility,y} = EG_{facility@Orosi,y} - ((M_T - M_{STP})\ EG_{facibility@Orosi,y}/M_T$ $EG_{facibility@Orosi}$ = Quantity of gross electricity generation that is produced by each plant in year *y* and is measured at the Orosi Substation (MWh/yr). M_T = Quantity of total gross electricity generation that is produced by all plants connected to the Orosi substation, in year *y* (MWh/yr) M_{STP} = Quantity of net electricity generation that is produced by all plants and fed into the grid in year *y* as measured at the Las Pailas substation (MWh/yr). Note that these are the same plants that deliver to the Orosi substation, but measured at a later point. The bidirectional meters at Las Pailas will measure both electricity generated that is being exported to the grid and the electricity that is consumed by the plants (imports).

	The data will be read primarily from the main meter. If an anomaly is detected in the data of the main meter, the data of the back-up meter will be used instead. The metering arrangements and the required quality control procedures to ensure accuracy are defined within the PPA between each relevant project instance and ICE.
Frequency of monitoring/recording	Monthly basis, recording continuously.
Value applied:	102,764 + 99,833 = 202,597 MWh/year (La Perla and Miramar instances respectively)
Monitoring equipment	Two bidirectional meters, a main meter and a back-up meter, will be installed at the Metering Point (ST Las Pailas) and in the Orosi Substation. The meters shall be advanced electronic socket meters, with an error no greater than 0.2 per cent (0.2%), with remote and real time communication facilities. Further details of the monitoring equipment is explained in the PPA page 24 and 85.
QA/QC procedures to be applied	Meter readings will be checked for completeness on a monthly basis and cross checked with the sales invoices. Verification of the meters will be done according to the PPA, every two years.
Purpose of data	Calculation of baseline emissions
Calculation method	The data/parameter will be read directly from the meters.
Comments	Data will be archived by means of electronic and paper backup for the full crediting period, plus two year years after the end of the Crediting period or the last issuance of CERs, whichever occurs later.

Data / Parameter	$EG_{facility@Orosi,y}$
Data unit	MWh
Description	Quantity of gross electricity generation that is produced by each plant in year y and is measured at the Orosi Substation (MWh/yr).
Source of data	Electricity meter reading.
Description of measurement methods and procedures to be applied	Two bidirectional meters will be installed at the Orosi Substation, a main meter and a back-up meter. The data will be read primarily from the main meter. If an anomaly is detected in the data of the main meter, the data of the back-up meter will be used instead. The metering arrangements and the required quality control procedures to ensure accuracy are defined within the PPA between each Project and ICE.

Frequency of monitoring/recording	Monthly basis, recording continuously.
Value applied:	A value was assumed directly for ***EG****facility,y* (see above)
Monitoring equipment	Two bidirectional meters, a main meter and a back-up meter, will be installed in the Orosi Substation. The meters shall be advanced electronic socket meters, with an error no greater than 0.2 per cent (0.2%), with remote and real time communication facilities. Further details of the monitoring equipment is explained in the PPA page 24 and 85.
QA/QC procedures to be applied	Meter readings will be checked for completeness on a monthly basis. Verification of the meters will be done according to the PPA, every two years.
Purpose of data	Calculation of the ***EG****facility,y*
Calculation method	The data/parameter will be read directly from the meters.
Comments	Data will be archived by means of electronic and paper backup for the full crediting period, plus two year years after the end of the Crediting period or the last issuance of CERs, whichever occurs later.

Data / Parameter	M_T
Data unit	MWh
Description	Quantity of total gross electricity generation that is produced by all plants connected to the Orosi substation, in year *y* (MWh/yr)
Source of data	Electricity meter reading.
Description of measurement methods and procedures to be applied	Two bidirectional meters will be installed at the Orosi Substation, a main meter and a back-up meter. The bidirectional meters will measure the total energy produced by all the Plants that are connected to the Orosi Substation. The data will be read primarily from the main meter. If an anomaly is detected in the data of the main meter, the data of the back-up meter will be used instead. The metering arrangements and the required quality control procedures to ensure accuracy are defined within the PPA between each Project and ICE.
Frequency of monitoring/recording	Monthly basis, recording continuously.
Value applied:	A value was assumed directly for ***EG****facility,y* (see above)
Monitoring equipment	Two bidirectional meters, a main meter and a back-up meter, will be installed in the Orosi Substation. The meters shall be advanced electronic socket meters, with an error no greater than 0.2 per cent (0.2%), with remote and real time communication facilities.

	Further details of the monitoring equipment is explained in the PPA page 24 and 85.
QA/QC procedures to be applied	Meter readings will be checked for completeness on a monthly basis. Verification of the meters will be done according to the PPA, every two years.
Purpose of data	Calculation of the $EG_{facility,y}$
Calculation method	The data/parameter will be read directly from the meters.
Comments	Data will be archived by means of electronic and paper backup for the full crediting period, plus two year years after the end of the Crediting period or the last issuance of CERs, whichever occurs later.

Data / Parameter	M_{STP}
Data unit	MWh
Description	Quantity of net electricity generation that is produced by all plants and fed into the grid in year *y* as measured at the Las Pailas substation (MWh/yr).
Source of data	Electricity meter reading.
Description of measurement methods and procedures to be applied	Two bidirectional meters will be installed at the Metering Point (Las Pailas Substation), a main meter and a back-up meter. The bidirectional meters will measure both electricity generated that is being exported to the grid and discount electricity that is consumed by the project (imports). The quantity of net electricity supplied by the proposed projects will be used to calculate the net energy provided by each project by accounting their transmission losses by using the equation: $M_T - M_{STP}$. The metering arrangements and the required quality control procedures to ensure accuracy are defined within the PPA between each Project and ICE.
Frequency of monitoring/recording	Monthly basis, recording continuously.
Value applied:	A value was assumed directly for $EG_{facility,y}$ (see above)
Monitoring equipment	Two bidirectional meters, a main meter and a back-up meter, will be installed at the Metering Point (ST Las Pailas). The meters shall be advanced electronic socket meters, with an error no greater than 0.2 per cent (0.2%), with remote and real time communication facilities. Further details of the monitoring equipment is explained in the PPA page 24 and 85.
QA/QC procedures to be applied	Meter readings will be checked for completeness on a monthly basis.

	Verification of the meters will be done according to the PPA, every two years.
Purpose of data	Calculation of the ***$EG_{facility,y}$***
Calculation method	The data/parameter will be read directly from the meters.
Comments	Data will be archived by means of electronic and paper backup for the full crediting period, plus two year years after the end of the Crediting period or the last issuance of CERs, whichever occurs later.

4.3 Monitoring Plan

In order to assure that the monitoring methodology (ACM0002 version 17.0.0) is correctly implemented in the determination of the emission reductions, a monitoring plan will be implemented. The plan incorporates QA/QC procedures, which are lined up with the quality control system of the project developer.

Determination of net electricity delivered to the grid ($EG_{facility,y}$)

The electricity measure and measurements gathering will be performed as determined in the PPA (clause 29) signed for each of the Project Instances.

INSTANCE 1: Campos Azules 20 MW Wind Project and INSTANCE 2: Altamira 20 Wind Project:

Electricity supplied to the grid by each of the Project Instances will be monitored at the Metering Point (Tejona Substation) through a Metering System. There will be two independent bidirectional meters for each of the Project Instances, one meter acts as the main meter and the second one acts as a back-up meter.

These Project instances have the following metering scheme:

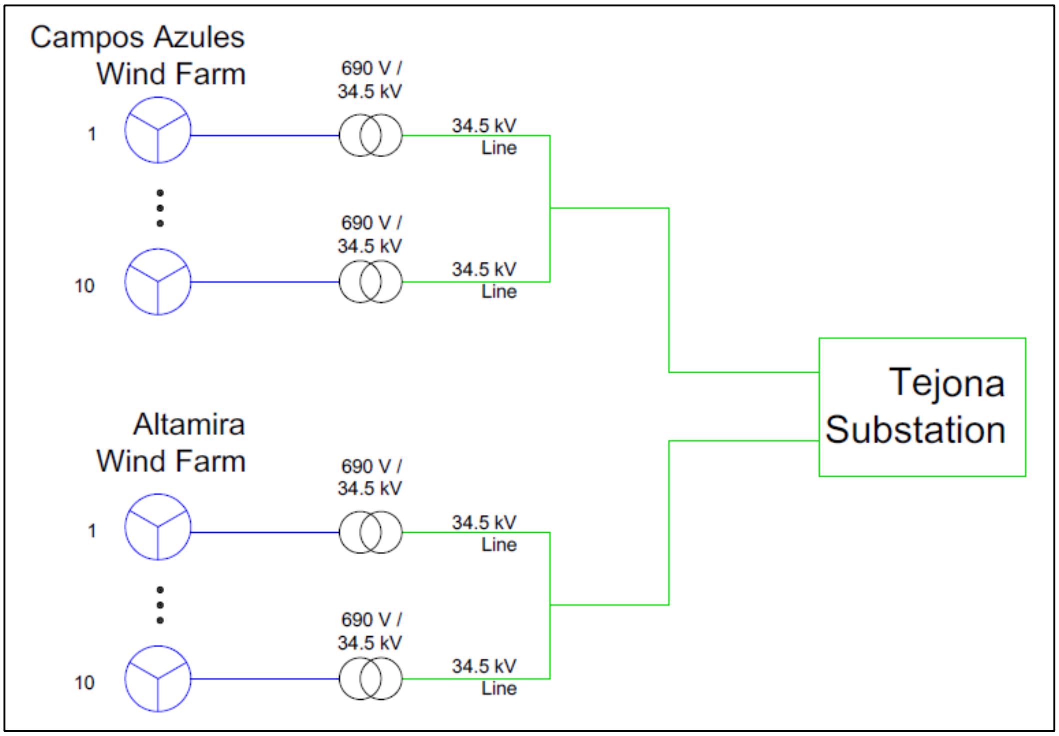

Figure 11. Metering Scheme INSTANCE 1 and 2

INSTANCE 3: Vientos de Miramar Wind Project and INSTANCE 4: Vientos de la Perla Wind Project

These Project instances will have the following simplified metering scheme as per explained in section 4.2:

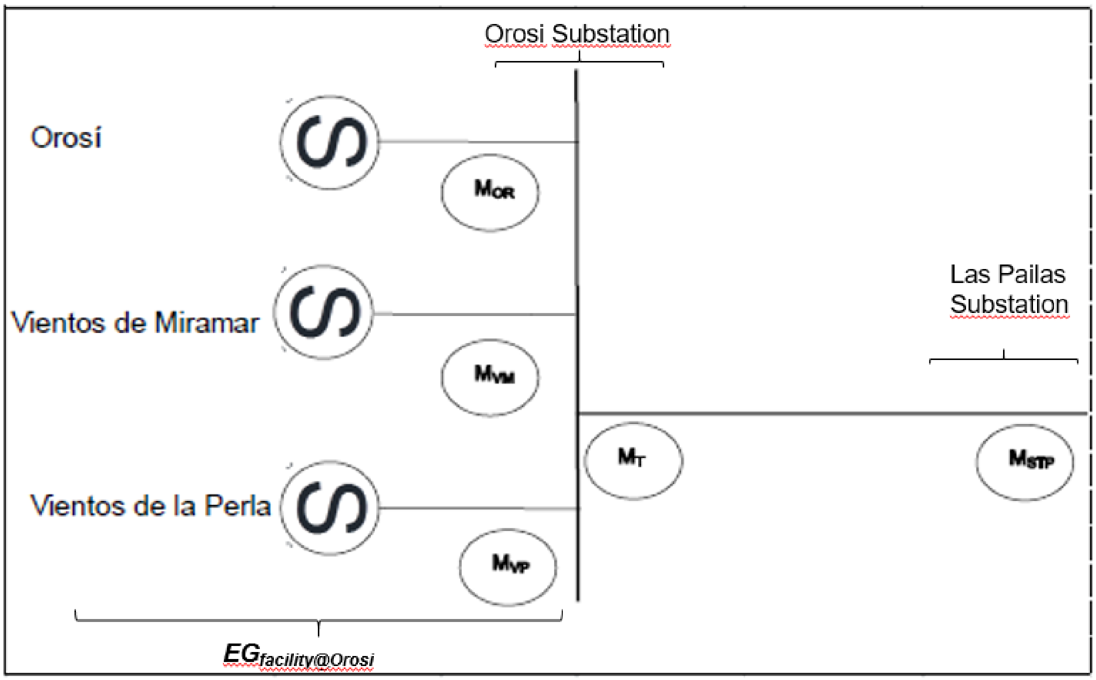

Figure 12. Metering scheme INSTANCE 3 and 4

The following equation shows how the delivered energy of each Project instance will be determined in a common period:

$EG_{facility,y} = EG_{facility@Orosi,y} - ((M_T - M_{STP})\ EG_{facibility@Orosi,y}/M_T$

Where:

- $EG_{facibility@Orosi}$ = Quantity of gross electricity generation that is produced by each plant in year y and is measured at the Orosi Substation (MWh/yr).

- M_T = Quantity of total gross electricity generation that is produced by all plants connected to the Orosi substation, in year y (MWh/yr)

- M_{STP} = Quantity of net electricity generation that is produced by all plants and fed into the grid in year y as measured at the Las Pailas substation (MWh/yr). Note that these are the same plants that deliver to the Orosi substation, but measure at a later point.

  The following methods for measuring, recording, storing, aggregation, collating and reporting data will be used for each to the Project Instances:

  As per the PPA and the Interconnection Agreement the received and delivered energy is recorded primarily from the main meter at the Metering Point on a monthly basis. Only in case an anomaly is detected in the main meter is the data registered in the backup meter used instead, as agreed between each project and ICE. Hence, the data obtained from the main meter (which is also used to develop the sales invoices) will be used to calculate emission reductions of the project in a specific monitoring period. In case both meters failed, the energy will be measured using the registered data on the backup system, which have to be also certified by ARESEP (Government Public Services Controller).

Every month (billing period), on the base of the energy delivered by the plant in the metering point, ICE will report the metering data to the Project, in case of Miramar and La Perla is will be calculated as explained above (page 81 of the PPA). Within that next 7 days after each billing period, in order for the Project to develop the sales invoices. In case ICE does not deliver this information within the established period, the Project may use its own meter to develop the invoice. The same data from the invoice is used for emissions reductions calculations.

In addition, the invoices are submitted to ICE for its revision and approval of the net energy established in the invoice. The meter readings/invoices are readily accessible for DOE.

All meter readings are entered into a logbook and excel spreadsheet. The “meter`s load profile” is also stored on a hard disk and a CD-ROM (BACK UP). All project documents related to the CDM project cycle will be kept on file for the entire crediting period duration plus two (2) additional years.

The metering arrangements and the required quality control procedures to ensure accuracy are defined within the PPA and Interconnection Agreement between the Projects and ICE.

Calibration of Meters and Metering and QA/QC procedures

The accuracy and frequency of verification for the meters is described in the PPA (Metering Equipment – Clause 29). Regarding verification procedures the PPA establishes, that the Parties will provide, install and give periodic maintenance to the measurement equipment. CENCE (ICE’s Energy Control Department) will manage the equipment (configuration, Parameterization and reading), perform audits of the measurement system when necessary and at least every two (2) years.

If there are discrepancies between the readings from the Project and ICE superior to 0.5%, either of the parties may request ARESEP to perform an accuracy assessment of any of the meters.

The metering arrangements and the required quality control procedures to ensure accuracy are defined between the Projects and ICE in the PPA and Interconnection Agreement. The precision class, requirements for meters and metering transformers, data recording and communication system, commissioning and periodic testing of the metering system, are agreed between project Developer and the power utility in the PPA.

The Metering Point for billing purposes of Vientos de Miramar and Vientos de la Perla Projects is located in Substation Las Pailas and for Campos Azules and Altamira in Tejona Substation.

Emergency procedures

The norms and operation procedures are established in the PPA. In case of emergencies the Operator shall follow the procedures established by the Buyer, which are clearly stated in the section mentioned above.

VCS management

Since the project participant 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 net amount of electricity that the project delivers to the grid.

Each project developer will implement a management structure where monitoring responsibilities will be explicitly defined. The Operations Department will be responsible for emission reductions monitoring, record keeping and the implementation of proper Q/A procedures. 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 organizational chart is provided below:

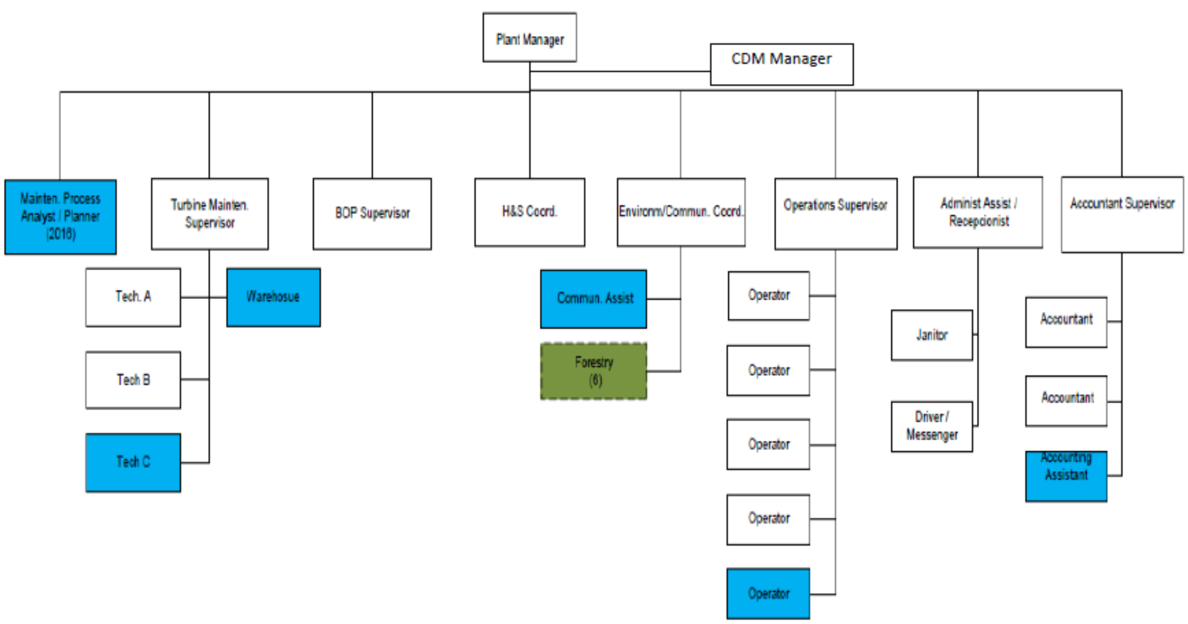

Figure 13. Organizational chart

Each of the Project´s Companies will have a person in charge of the carbon credits monitoring (CDM Manager), and support the Plant Manager on these activities, according to the following responsibilities matrix:

Table 30. Responsibilities matrix

	Plant Manager	Operations Supervisor	CDM Manager
Collect data			
Power delivered to grid	R	E	
Ensure calibrations and data quality	R	E	I
Process data			
Input of raw data in spreadsheet		R/E	I
Cross check data and correct		R/E	I
Calculate emission reductions	I	R	E
Quality check calculated emission reductions	I	I	R/E
Reporting and archiving			
Report data gaps and errors	I	R/E	I
Report emission reductions to date	I	R/E	R/E
Archiving of procedures and certificates	I	R	E
Archiving of data	I	E	R

E = Execute; R = Responsible; I = To be informed

5 SAFEGUARDS

5.1 No Net Harm

No potential negative socio-economic impacts are generating by the grouped project.

Overall, the projects have a low impact on the physical, biological and socio-economic aspects and are located in an area where other wind projects are immersed in the community and provide a boost to the local economy and tourism.
A summary of the environmental impacts in the area of direct influence (ADI) and the area of indirect influence (AII) of the Projects during the construction phase is shown in the table below.

Table 31. Environmental Impacts during construction phase

Environmental Factor	Impact
Soil	Alteration of the geomorphological characteristics in site due to road construction and excavation works.
	Risk of soil contamination due to use of machinery fuels and oils.
	Risk of pollution due to insufficient solid waste management.
Underground water	Potential pollution of water in the use of machinery fuels and oils.
	Risk of pollution due to the presence of wastewater.
Air	The air's quality will be affected during the cleaning and the clearing of lands, the transportation and gathering of materials, especially in the dry season.
	The sound level will be increased due to the implementation and operation of provisional installations, the cleaning and clearing of lands, excavations, transportation and gathering of materials.
Natural Hazards	There's risk of landslides due to a natural occurrence.
Landscape	Improvement in the landscape due to the recovery of dumps.

	Modification of the scenery due to erection of wind turbines.
Flora	Affectation to the flora due to the removal of trees and vegetation.
Fauna	The removal of flora may generate the alteration of natural habitats. The sound levels may induce some mammals to relocate to other habitats.
Bird Life	Temporal displacement of some birds due to high sound levels.
	The wind turbines may represent obstacles to the flight path of birds.
Occupational Health	Risk of worker accidents due to the use of heavy machinery and the involvement in construction activities.
	Affectation occupational health due to the use and storage of machinery fuels and oils.
Road infrastructure	Deterioration to external roads due to transit of heavy machinery.
Local economy	Benefit in the local economy due to the need of acquiring goods and services.
Neighbors	Discomfort due to the presence of dust during the soil movement and excavation works.
	Discomfort due to the rising of sound levels.
Communities	Uneasiness due to the transit of heavy machinery
Archaeological Remains	Positive impact because of the archaeological supervision during the excavation works.

A summary of the environmental impacts in the ADI and AII during the operation phase is shown in the table below:

Table 32. Environmental Impacts during operation phase

Environmental Factor	Impact
Soil	Positive impact due to the recovery of vegetation in the process of eliminating soil erosion.
	Risk of soil contamination due to use of machinery fuels and oils.
	An adequate management of solid wastes will prevent any contamination of the soil.
Underground water	Potential pollution of water due to the use of machinery fuels and oils.
	Risk of pollution due to the presence of wastewater.
Air	A minimal amount of households will be affected by the noise generated during the operation of the project. The projected sound levels are in compliance with IFC standards and national regulations.
	Positive impact in air quality due to the production of clean energy.
Natural Hazards	The infrastructure is subject to earthquakes of great magnitude.
Landscape	Positive impact of the scenery due to the presence of the wind turbines.
	Positive impact of the landscape due to reforestation duties.
Flora	Positive impact on the flora due to reforestation duties.
Fauna	Positive impact on the flora due to reforestation duties with local species of flora, enhancing the habitat of local fauna.
Bird Life	Positive impact on the flora due to reforestation duties with local species of flora, enhancing the habitat of local bird life.
	The wind turbines may represent an obstacle to the flight path of birds.

Occupational Health	Improvement in the occupational health of the workers.
Road infrastructure	The project will generate taxes that will be given to the local government. These taxes will be used for road improvement and other works.
Local economy	The local economy will be benefited by the rise of tourism in the area due to the presence of the Project.
Employment (Direct & Indirect)	The project will hire local workforce for the operation of the project. Indirectly, the project will require the goods and local services for the different activities.
Neighbors	The neighbors may be visually uncomfortable by the presence of the project. A minimal amount of households will be affected by the noise generated during the operation of the project. The projected sound levels are in compliance with IFC and national regulations.
Communities	The neighboring communities will be benefited by the project due to the hiring of local workforce and improvement of basic services.
Basic services	The project will provide 20 MW of electrical installed capacity, strengthening the national electrical grid.

The Environmental Management Plan approved by the projects enlist the steps and measures to mitigate the impacts mentioned above:

A summary of the measures considered for environmental impacts during the construction and operational phase are shown below.

CONSTRUCTION PHASE

The mitigation measures to be implemented are detailed below:

Environmental Factor: Soil

- Carry out the amount of ground movements required under the corresponding runoff and dust control parameters.
- Re-use the extracted material as much as possible.
- Correct arrangement and administration of the accumulated material within the PA (Project Area).
- Requirement of Technical Review in the machinery that operates in the PA.
- Supply and maintenance of machinery outside the PA or according to established conditions.
- Availability of special materials that allow the immediate cleaning of spills.
- Adequate management and maintenance of the waste areas, through the application of the Waste Management Plan.
- Promote the waste separation by type.
- Correct material disposal within the PA.
- Implementation of the Waste Management Plan.

Environmental Factor: Air

- Maintain the sound emissions levels below the established limits in the current legislation, in order to avoid damages on the welfare and health of the community in general and the area of direct influence of the project, through the implementation of the mitigation measures.
- Avoid excessive pollution of the air resulting from the combustion of hydrocarbons by the machinery operating during the construction phase, by means of demanding the Technical Review and the Machinery Maintenance Plan.
- Compliance with the waste management plans, as well as maintenance of internal streets.

Environmental Factor: Surface water

- The project commits to implement an efficient rainwater harvesting system that will guarantee the correct channeling of rainwater.
- Avoid water contamination from the use of hydrocarbons or other polluting substances, in activities during construction and extraction of the machinery that operates in the project´s execution.
- Avoid possible contamination of surface water due to incorrect waste management, by verifying compliance with mitigation measures from the Waste Management Plan.
- Use of geotextiles to contain sediments. Execution of works contemplating the collection and adequate evacuation of rainwater.

Environmental Factor: Groundwater

- The project is committed to ensure compliance of the detailed mitigation measures to minimize the impact on the groundwater of the PA.
- Application by the Contractor of Environmental Management Plans and Protocols necessary to avoid potential water pollution.
- The commitment is to evaluate the contractor on the appropriate collection system and transportation of wastewater.

Environmental Factor: Flora and Fauna

- The project is committed to comply with the mitigation measures and the Ecological Restoration Plan.
- The commitment is to carry out the relevant procedures for tree cutting and the implementation of an Ecological Restoration Plan.
- The project is committed to promote the regeneration of the vegetation coverage through reforestation and landscape works with native species. Constant cleaning of the PA.

Environmental Factor: Human

- Avoiding detriment of the local road and of the viability conditions and transportation in the area.
- Avoid work and traffic accidents.
- The project is committed to label and maintain the machinery transit speed limits, as well as to comply with the Contractor's Transit and Transport Management Plan.
- Avoiding the detriment of workforce on site and the potential risks associated with construction works through compliance of mitigation measures.
- The project commits to act based on the detailed mitigation measures.
- The project commits itself to hire personnel that resides in the area as far as possible and subject to availability, and to guarantee their work benefits.

OPERATIONAL PHASE

Environmental Factor: Soil

- - The developer commits to classify, store and dispose in a correct way each of the different types of hazardous substances that are handled in the operation of the wind farm, by applying a “Hazardous Substance Spill Management Protocol”.

Environmental Factor: Air

- - Keep levels of sound immissions below the limits established in the current legislation and the Project´s direct influence area.

Environmental Factor: Surface water

- - The developer commits to implement detailed mitigation measures to avoid contamination of surface waters.
- - The developer commits to develop the Waste Management Plan and thus minimizes the risk of water pollution.

- - The developer commits to train all staff for the application of good practices in the rational use of water resources.
- - Avoid wasting water resources through the implementation of saving techniques (efficient devices and training of employees).

<u>Environmental Factor: Groundwater</u>

- - The developer is committed to properly design, build and maintain the sewage treatment system to avoid any type of environmental contamination.

<u>Environmental Factor: Biological Environment</u>

- - Implement a Bird and Bat Monitoring Plan that allows the decision making and implementation of mitigation measures (if necessary). .
- - The Bird and Bat Monitoring Plan includes a specific section to study the effects of the Wind Farm on birds and bats.

<u>Environmental Factor: Human</u>

- - Provide all necessary inputs to comply with the mitigation measures.
- - Ensure the safety of workers by providing the necessary training and equipment to avoid work accidents.
- - Ensure to generate the least visual impact within the scope of project development.
- - The compromise is to consider the inconvenience impacts of the community in terms of noise, within the design factors regarding the location of the wind turbines, with the aim of diminishing it.
- - The developer agrees to comply with the mitigation measures detailed in Environmental Study to minimize the impacts of Shadow Flicker and Leaf Sheen (in case of occurrence).
- - The developer's commitment is to operate a wind farm that encourages the production of renewable energy in the country.
- - The developer commits to hire/contract the goods and services in the surroundings of the PA as long as they meet the requirements of quality and economic feasibility.
- - The developer is committed to promote alternative tourism in order to benefit nearby communities.

5.2 Environmental Impact

The four projects developed an EIA in compliance with the Executive Decree “N°32966 MINAE – Manual of Technical Instruments for the Process of the Impact Assessment Evaluation” and published in the official local newspaper “La Gaceta” on the 4th of May 2006. The assessment contains details of the fieldwork investigations, analysis and interpretation of data as well as results obtained from the assessment.

For each of the projects, the project developer put together a multi-disciplinary group of professionals in order to conduct several fieldwork studies. The EIAs were made with the results of these fieldwork studies. The outcomes of the research were gathered in a report, being able to make a characterization of the physical, biological and socio-economic factors of the study. Each professional made a diagnostic and evaluation of the environmental impacts found in the studies, leading to the necessary prevention, mitigation and/or compensation measures found in the EIA.

Furthermore, an Environmental Management Plan (EMP) was made as part of the EIA, with the purpose to avoid, mitigate, amend or compensate the possible negative impacts of the project activity. This EMP organizes the mitigation measures according to the activities that generate impacts, environmental factors affected by these activities, applicable legislation, phases in which each step will be implemented and the responsible in charge of each measure.

The assessment contemplates both the area of direct influence (ADI) and the area of indirect influence (AII). The ADI is the space that will receive direct influence of the physical, biological and socio-economic impacts of the Project.

The ADI represents for each project:

1. For Campos Azules and Altamira Wind Projects this zone has an area of 1,844,011.04 m^2. The area that will receive indirect impact from the Project are the towns of Los Ángeles, Ranchitos, Parcelas de Quebrada Azul, Sabalito, Tilarán Downtown and Los Moisos.

2. For Vientos de Mirarmar and Vientos de La Perla Wind Projects this area was defined as a space of direct influence of 500 meters around the projects. The area of direct socioeconomic influence includes the towns of Quebrada Grande and El Consuelo. And for the biological ADI was established a perimeter of 1000 meters around the projects. In this range of ADI are included ecosystems such as those present in Guanacaste National Park.

The EIAs presented enough arguments demonstrating that the Projects contribute to the sustainable development of the country and nearby communities. The EIAs state that the Projects' construction, operation and maintenance activities sustain the quality of life, maintain the continuous access to natural resources, solves present needs and avoids lasting environmental damage without jeopardizing the capacity of future generations to solve their future necessities.

The aforementioned assessments determine that the proposed projects activities are environmentally viable. The negative impacts are temporary and reversible. The impacts can be mitigated with the application of the Environmental Management Plan. On the other hand there is a positive impact as to job creation due to the hiring of equipment, personnel, services and creation of indirect sources of jobs.

1. **INSTANCE 1: Campos Azules 20 MW Wind Project**

According to Resolution No. 593-2014 SETENA, dated March 24, 2014, the Environmental Impact Study (EIS) for the Campos Azules Wind Project was approved and the Environmental viability granted.

2. **INSTANCE 2: Altamira 20 MW Wind Project**

According to Resolution No. 1839-2014-SETENA, dated September 10, 2014, the Environmental Impact Study (EIS) for the Altamira Wind Project was approved and the Environmental viability granted.

3. **INSTANCE 3: Vientos de Miramar Wind Project**

According to Resolution No. 1036-2014-SETENA, dated May 30, 2014, the Environmental Impact Study (EIS) for the Vientos de Miramar Wind Power Project was approved and the Environmental viability granted.

4. **INSTANCE 4: Vientos de La Perla Wind Project**

According to Resolution No. 1060-2014-SETENA, dated June 04, 2014, the Environmental Impact Study (EIS) for the Vientos de La Perla Wind Power Project was approved and the Environmental viability granted.

5.3 Local Stakeholder Consultation

1. INSTANCE 1: Campos Azules 20 MW Wind Project and INSTANCE 2: Altamira 20 Wind Project

The stakeholder consultation, for the Campos Azules and Altamira Projects, took place on Wednesday 5 of November 2014 at 6 p.m. in the community hall of Parcelas, Tilarán, Guanacaste, Costa Rica. 31 community members attended the event.

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

The stakeholder consultation was announced in the following ways:

- The developer announced the stakeholder consultation in one of the most popular newspapers in Costa Rica “Al día” on October 28th, 2014, one week before the event[15];

- The developer sent personalized letters inviting several institutions and stakeholders such as:
    - Municipality of Tilarán;
    - ASADA[16] Parcelas;
    - ASADA Rio Piedras;
    - Development Association of Tierras Morenas (Asociación de Desarrollo de Tierras Morenas);
    - Development Association of Quebrada Azul (Asociación de Desarrollo de Quebrada Azul);
    - Development Association of Los Angeles of Tilarán (Asociación de Desarrollo de Los Ángeles de Tilarán);
    - Manager of Tejona Wind Park, Costarican Institute of Electricity (ICE);
    - Land owners;
    - Neighbors of the communities involved;

- Placing of adverts in public places around the community. The following is an example of the posting of an advert in the local police station, grocery store, in a bus stop and other places in the community.

Figure 14. Adverts

[15] A respective copy of the announcement can be presented upon request.

[16] ASADA: Asociaciones Administradoras de Sistemas de Acueductos y Alcantarillados Sanitarios (Aqueduct and Sewer Systems Administrative Associations)

The stakeholder consultation was led by the Project Owner and project developer and included a brief power point presentation with a description of the project and its status, and how the project is mitigating climate change through the emission reductions by using the wind as fuel.

The following pictures were taken during the stakeholder consultation:

Figure 15. Stakeholder consultation (Campos Azules and Altamira)

After the presentation a period of time was given to all participants to submit their questions in written form to the project developer and give comments. A video of the entire stakeholder presentation is available and can be submitted upon request.

Overall, the participants have a good perception of the projects. At the end of the stakeholder consultation, some comments and questions by the participants were compiled and exposed by the expositor. The main topics discussed are summarized below:

a) The topic the participants asked the most is regarding the training and hiring of community members. They wanted to know the programs that the Projects will implement to benefit the community in this aspect;
b) One person was concerned about the condition of the roads after the construction of the Project. He was interested in the Project's plans of the improvement of roads not directly affected by the Project;
c) Several stakeholders asked about the social programs the project will implement in the neighboring communities, as well as the budget designated for this purpose. One participant had interest in the support to the Sabalito community;
d) One stakeholder wanted to know the involvement of neighbors in the community and they say they have in the social programs that the project wants to implement;

e) Personnel from the Municipality of Tilarán asked if the project could donate workforce to the municipality in order to solve several needs of the towns;
f) One person asked the structure and requirements of social responsibility asked by investment banks; specifically the percentage that should be invested in social responsibility by the project;
g) A participant wanted to know if the PoA would benefit reforestation efforts.

Each question received satisfactory and comprehensive answers by the Project developers; finally the parties stated agreements and commitments.

The Project developers took into consideration all the suggestions and expressions of the stakeholders and clarified all concerns and answered all questions by providing relevant information to the satisfaction of the participants.

A detailed minute of meeting delineating the above questions and the responses have been recorded and written down. This is available upon request.

The project developers explained that a social diagnosis is needed and will be done by the company to determine the needs of the community and the required training areas. Hence, meetings with the stakeholders of each community will be organize in order to prioritize what are the main needs of the people and towns surrounding the project.

Regarding the training of local people, the Project developers mentioned that with Plantas Eólicas SRL (PESRL)[17] (another project owned by the project developer company) they have a scholarship fund for people with low income. Furthermore, they explained that nowadays primary and high school students visit the PESRL plant in order to learn about wind farms. This form of training of young people will occur as well with the proposed project activity. It is also possible for the project developer to form alliances with other foundations in order to impart renewable energy courses in the communities.

The Project developers also stated that they're planning to hire and train local workforce in order to insert them into maintenance and operating roles of the plant. As an example, in PESRL, several staff (local people) went to Honduras to train other personnel.

However, the representative of Project developers mentioned that the Projects can't force the EPC Contractor to hire local workforce for all the activities but they can recommend local labor for the construction phase. It's possible to elaborate a database of local labor and machinery to help the hiring of personnel. The Project developers also stated that indirect labor would be generated by the projects.

During the stakeholder consultation, the Project developers mentioned that the social diagnosis would be the first step they'll do, being possible to determine the needs of the communities and prioritize the social works to do. The idea will be to create alliances with other companies, local government and/or development organizations in order to join different efforts. It was stated that the social works will increase during the operating phase.

It was also told that the Projects will elaborate an analysis of the conditions of roads that may be affected during the construction phase. Once the construction phase concludes, the Projects will fix the roads that were affected by the transit of heavy machinery, returning them to their previous state.

Currently, donating the time personnel for several activities of the local government is part of the social program of PESRL, therefore it's expected that the Projects will work alongside with the Municipality of Tilarán in other social activities too.

[17] First Wind Park in Latin America

The Project developers stated that the financial entities have engineers that inspect several stages of the projects, including the relocation of neighbors and the possible social and environmental impacts. Whilst the bank requirements vary from one entity to another, the developer follows the IFC standards.

Finally, it's important to emphasize that residents and the local government are all very supportive of the proposed projects activities.

2. INSTANCE 3: Vientos de Miramar Wind Project and INSTANCE 4: Vientos de la Perla Wind Project

Previous meetings were given between the developer and the community, to inform about the projects and know about the local position towards these projects. On Saturday 16 of March 2013[18], a workshop took place in the community hall of Quebrada Grande, to accomplish this objective. In this activity participated about 40 community members, including local authorities.

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

Another stakeholder consultation for the projects, took place on Tuesday 24 of November 2015 at 6 p.m. in the facilities of Quebrada Grande High School, Guanacaste, Costa Rica. 102 community members attended the event[19].

The stakeholder consultation was announced and conducted by the developer, Alisios Team, taking advantage of its already consolidated network of contacts, the invitation was extended to the representatives of the local organizations of Quebrada Grande, Las Lilas and Los Angeles, Association of Integral Development (ASODEI), extending also the invitation to the settlers of these communities in general, as well as the owners of properties where it will be installed The Project team and local authorities of the Municipality of Liberia and the Conservation Area of Guanacaste (ACG).

The objectives of this presentation were: (a) the development of a bound between the community, the developer and the consultancy team for the Evaluation of Environmental Impact. (b) Inform in an objective and complete way the community about the project of the technical facts, benefits, possible impacts and mitigation measures plan for its different stages during construction and operation (c) Register the local position of the community for the project development.

The following pictures were taken during the stakeholder consultation:

[18] This information is included in the Environmental Impact Study presented for each project to the SETENA, in chapter 9, as part of the *Compilation of Qualitative Information*, pages 97 – 102 for Vientos de la Perla Wind Project and pages 96-100 for Vientos de Miramar Wind Project.

[19] Report of the meeting log of "PRE CONSTRUCTION INFORMATION MEETING".

Figure 16. Stakeholder consultation (Vientos de Miramar and Vientos de la Perla)

The stakeholder consultation was developed including the next activities:

1) An introduction where it was explained the objective and principal characteristics of the activity. This part was directed by the President of the Association of Integral Development (ASODEI).
2) The next part of the meeting was a series of presentations of the different aspects of the project. The technical aspects were developed by Jorge Zapata (Construction Manager) of Alisios Team, the environmental aspects by Marianela González, and Carolina Baltodano and Jenny Brizuela focus their presentation on the social aspects.
3) After the meeting a space was opened for questions and answers from the consultancy team.
4) The final results were included in the record of the meeting; which is available by request.

Overall, the participants have a good perception of the projects. At the end of the stakeholder consultation, some comments and questions by the participants were compiled and exposed by the Project developers' representatives. The main topics discussed are summarized below:

a) About the possible donations that could be made to communities and how to be taken into account for new position jobs.
b) Some important clarifications were that donations and social investment projects will be coordinated at all times with ASODEI and that this Association will be kept informed about progress in the construction.

c) During the presentation the mechanism of nonconformities was discussed and the neighbors were urged to use it if they considered that the construction of the projects is causing them negative impacts.
d) The Association of Integral Development (ASODEI) requested for the construction schedule. This point was considered as an agreement of the meeting.

Each question received satisfactory and comprehensive answers by the Project developers; finally the parties stated agreements and commitments.

The Project developers took into consideration all the suggestions and expressions of the stakeholders and clarified all concerns and answered all questions by providing relevant information to the satisfaction of the participants.

As a result of the meetings there were develop three main axes (included in the official document presented to the SETENA[20]):

- Information of the projects to the community
- Influence of the projects directly to the community
- Bound between the projects and the community

One on the main concerns of the people was regarding the possibility of new sources of jobs. Also the intervention on local infrastructure was one of the more important interests recognized in the community.

The project organization came to the agreement to keep in communication with the community members, over the advances and facts of the projects.

The people whom participated of the consultation had a positive perception of the projects, regarding to the energy production and the attraction for new tourism activities.

For the success of this initiative, it became clear during the activity that it was necessary the participation and interest of the villagers, who through their local leaders could promote a cooperative relationship with the projects. This will also define the real scope of collaboration, thus avoiding false expectations.

5.4 Public Comments

Not applicable.

[20] Secretaría Técnica Nacional Ambiental (SETENA)