



RUBY CANYON ENGINEERING

Validation Report for MS Renovaveis
Wind Power Complex: Mar e Terra,
Areia, Branca, Embuaca and Icarai
ACR 191

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Ruby Canyon Engineering
743 Horizon Ct. Suite 385
Grand Junction, Colorado 81506
(970) 241-9298

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INTRODUCTION

This report is documentation of validation activities that Ruby Canyon Engineering (RCE) performed for the MS Renováveis Wind Power Complex: Mar e Terra, Areia Branca, Embuaca and Icarai project (project), all located in Brazil. RCE reviewed the Greenfield project information as described in the Project Plan “MS Renováveis Wind Power Complex: Mar E Terra, Areia Branca, Embuaca and Icarai” dated June 2015. The objectives of the validation are to evaluate:

- Conformance to the ACR standard and any applicable sector standard
- GHG emissions reduction project planning information and documentation in accordance with the applicable ACR-approved methodology, including the project description, baseline, monitoring and reporting procedures, and quality assurance/quality control (QA/QC) procedures
- Reported GHG baseline, ex ante estimated project emissions and emission reductions/removal enhancements, leakage assessment, and impermanence risk assessment and mitigation (if applicable)

1 VALIDATION BODY

RCE is currently an approved verifier for the American Carbon Registry (ACR), California Air Resources Board (ARB), Climate Action Reserve (CAR), Verified Carbon Standard (VCS), The Climate Registry (TCR), British Columbia GHG Regulation, and the Massachusetts Department of Environmental Protection GHG Registry (MassDEP). The American National Standards Institute (ANSI) accredited RCE to validate Scope 1 projects (including renewable energy) on October 6, 2011.

Contact Information:

Ruby Canyon Engineering, Inc.
743 Horizon Court, Suite 385
Grand Junction, CO 81506
(970) 241-9298

Validation Team:

Lead Validator - Michael Coté
Independent Reviewer – Bonny Crews
Validator – Phillip Cunningham
Validator – Ronald Collings P.E. (Financial Expert)
Validator – Cintia Dias (Brazil Expert)

2 PROJECT TITLE

MS Renováveis Wind Power Complex: Mar e Terra, Areia Branca, Embuaca and Icarai

Validation period 7 years from June 29, 2013 through June 28, 2020

ACR project ID: ACR191

3 CRITERIA

3.1 STANDARDS, GUIDELINES, AND TOOLS

- MS Renováveis Wind Power Complex: Mar E Terra, Areia Branca, Embuaca and Icarai Project Plan (June 2015)
- ACR Standard, Version 3.0 (February 2014)
- ACR Validation and Verification Guideline, Version 1.1 (June 2012)
- ACM0002: Grid-connected electricity generation from renewable sources version 15.0
- CDM Tool to calculate the emission factor for an electricity system version 04.0
- CDM Tool for the demonstration and assessment of additionality version 07.0.0
- CDM Guidelines on the assessment of investment analysis version 05
- CDM Guidelines on Common Practice version 02.0

3.2 ACR ELIGIBILITY

RCE confirmed the following ACR eligibility criteria listed in the ACR Standard, Version 3.0 by reviewing the project proponent's Project Plan, Monitoring Plan, and calculations as well as other support documentation described throughout this report (a full list of documents reviewed is located in Appendix A). In addition, RCE confirms the proposed renewable project is less than 100 MW in size.

- Start Date: the project start date is June 29, 2013, which is post January 1, 2000 and is not more than two years prior to the date of listing with ACR.
- Minimum Project Term: projects with no risk of reversal subsequent to crediting have no required minimum project term.
- Crediting Period: the crediting period is seven years.
- Emission or Removal Origin: RCE confirmed Project reduces energy-related indirect emissions and takes place in a non-Annex 1 country (Brazil).
- Offset Title: RCE confirmed that the project proponent has undisputed title to all offsets.
- Land Title: RCE confirmed that the project proponent has clear and uncontested land title to the wind farms.
- Additional: RCE confirmed that the project is additional as described in Section 4.5.
- Permanent: the project will generate emission reductions that are permanent and have no risk of reversal.
- Net of Leakage: ACM0002 does not consider leakage.
- Independently Validated and Verified: RCE is a third party validation and verification body that the project proponent has contracted in order to validate the project.
- Community & Environmental Impacts: RCE reviewed project impacts as described in section 4.7 of this report.

4 VALIDATION OBJECTIVES, SCOPE, AND ACTIVITIES

4.1 PROJECT BOUNDARY

Based on the approved baseline and monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” Version 15.0, the proposed project boundary (spatial extent) includes the renewable power generation plants/units (*Mar e Terra*, *Areia Branca*, *Embuaca* and *Icaraí*) physically connected to the Brazil interconnected national electricity system.

4.2 PHYSICAL INFRASTRUCTURE, ACTIVITIES, TECHNOLOGIES, AND PROCESSES

The proposed project activity consists of four wind power plants: *Mar e Terra*, *Areia Branca*, *Embuaca* and *Icaraí*, with 23.1 MW, 27.3 MW, 27.3 MW and 16.8 MW of installed capacity respectively. The project activity consists of a total installed capacity of 94.5 MW and delivery of electricity to the Brazil electric grid. The annual electricity output is expected to be 342,604 MW-hrs, with an average plant load factor of 41.

MS Participações Societárias S.A. controls four Specific Purpose Entities (SPEs) that own the wind power plants:

- *Eólica Mar e Terra Geração e Comercialização de Energia S.A.* (WPP Mar e Terra);
- *Eólica Bela Vista Geração e Comercialização de Energia S.A.* (WPP Areia Branca);
- *Embuaca Geração e Comercialização de Energia S.A.* (WPP Embuaca);
- *Eólica Icaraí Geração e Comercialização de Energia Ltda* (WPP Icaraí).

The four wind power plants included in the project activity all use newly-built Suzlon Energy Limited S-88 and S-95 2.1 MW wind turbines. In addition, the plants provide electricity to the grid through four new transmission lines installed as part of the project activity. The description of four wind power plants and transmissions lines are as follows:

- ❖ *Mar e Terra* wind power plant (23.1 MW).
 - *Mar e Terra* consists of 11 wind turbines connected to the grid through a 230 kV transmission line that connects *Areia Branca* substation to *Mossoró II* substation that a local power utility (*CHESF - Companhia Hidroelétrica do São Francisco*) owns. The 52 kilometer transmission line extends through two municipalities; *Areia Branca* and *Mossoró*.
- ❖ *Areia Branca* wind power plant (27.3 MW).
 - *Areia Branca* consists of 13 wind turbines connected to the grid through a 230 kV transmission line that connects *Areia Branca* substation to *Mossoró II* substation that a local power utility (*CHESF - Companhia Hidroelétrica do São Francisco*) owns. The 52 km transmission line extends through two municipalities; *Areia Branca* and *Mossoró*. In addition, *Areia Branca* wind power plant includes a separate 34.5 kV transmission line to connect *Areia Branca* wind power plant to *Areia Branca* substation 34.5/230kV. This transmission line is approximately 1.2 km in length.

❖ *Embuaca* wind power plant (27.3 MW).

- *Embuaca* consists of 13 wind turbines connected to the grid through a 34.5 kV transmission line that connects *Falsa* substation located at the municipality of *Trairi*, state of *Ceará*. The *Falsa* substation is interconnected to *Pecém II* substation that the local power utility (*Companhia Hidro Elétrica do São Francisco – CHESF*) controls. This transmission line is approximately 12 km in length.

❖ *Icaraí* wind power plant (16.8 MW).

- *Icaraí* consists of 8 wind turbines and is connected to the grid through a 69 kV transmission line that connects *Icaraí* substation to the *Marco* substation that a local power utility (*COELCE – Companhia Energética do Ceará*) owns. The 60 km transmission line extends through two municipalities; *Amontada* and the state of *Ceará* to *Marco*.

4.2.1 Location of the wind power plants

All of the wind power plants are located in northeastern Brazil. *Mar e Terra* and *Areia Branca* are located in Rio Grande do Norte State and *Embuaca* and *Icaraí* are located in *Ceará* State. Table 1 shows the four wind power projects' specific locations based on their Agência Nacional de Energia Elétrica (ANEEL) Ordinances.

Table 1 – Wind Farm Locations

| GEOGRAPHIC COORDINATES | MAR E TERRA ¹ | AREIA BRANCA ² | EMBUACA ³ | ICARAÍ ⁴ |
|------------------------|--------------------------|---------------------------|----------------------|---------------------|
| Longitude (West) | -36.9177 | -36.9034 | -39.3294 | -39.6292 |
| Latitude (South) | -4.9736 | -4.9772 | -3.2182 | -3.0179 |

4.3 GHGs, SOURCES AND SINKS WITHIN THE PROJECT BOUNDARY

Table 2 shows the GHG emission sources included in the project boundary based on guidance from ACM0002.

Table 2 – GHG Emission Sources

| Source | GHG | Description |
|------------------|-----------------|---|
| Baseline | CO ₂ | CO ₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. |
| project Activity | N/A | No project emissions included. |
| Leakage | N/A | No leakage included. |

¹ *Mar e Terra* geographic coordinates are described in ANEEL Ordinance #867, dated October 25, 2010.

² *Bela Vista* geographic coordinates are described in ANEEL Ordinance #741, dated August 19, 2010.

³ *Embuaca* geographic coordinates are described in ANEEL Ordinance #732, dated August 17, 2010. .

⁴ *Icaraí* geographic coordinates are described in ANEEL Ordinance #601, dated June 30, 2010.

4.4 DESCRIPTION OF AND JUSTIFICATION FOR THE BASELINE SCENARIO

The project activity is the installation of a Greenfield power plant. According to ACM0002, “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 that 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’”.

4.4.1 Application of selected baseline and monitoring methodology

The project correctly applies the approved baseline and monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, Version 15.0 (June 1, 2014).

The proposed project activity meets the applicability criteria defined in ACM0002, Sec. 2.0. The baseline methodology is applicable to grid-connected renewable 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 plant(s); or
- (d) involve a replacement of (an) existing plant(s).

RCE reviewed the applicable licenses, permits, and concessions for electricity generation and delivery to the grid, and conducted a site inspection to each of the four wind power plants to confirm that the project activity corresponds to (a) above (Greenfield plant).

ACM0002 is applicable under the following conditions (non-hydro):

- The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;

The project activity applies the “Tool to calculate the emission factor for an electricity system” version 4.0, (October 4, 2013). The tool determines CO₂ emission factors by calculating the “combined margin” (CM) of baseline emissions for project activities that displace grid electricity. In 2008, Brazil defined the Brazilian Interconnected Grid as a single system covering all five geographic regions of the country. Brazil’s Electricity Regulatory Agency (ANEEL) publishes the CM emission factor data used in the project calculations. The CM is based on the official Brazil country values that the Science and Technology Ministry⁵ calculates and updates annually⁵.

RCE confirmed that the project activity will supply electricity to the Brazilian Interconnected Grid, that the selected baseline and monitoring methodology are applicable to the project and that the project complies with all the applicability conditions therein at the time of submission of the proposed project activity for ACR registration.

⁵ <http://www.mct.gov.br/index.php/content/view/74689.html>

4.4.2 Baseline identification

Based on ACM0002 version 15.0, if the project activity is the installation of a new grid-connected renewable power plant/unit the baseline scenario is the following:

“Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the ‘Tool to calculate the emission factor for an electricity system’ (version 4.0). The emission factor data used in the project activity is based on data provided by the ANEEL.”

RCE reviewed the documented evidence listed above during the validation process and confirmed that the project proponent correctly applied ACM0002, version 15.0. RCE confirmed that the baseline scenario reasonably represents what would occur in the absence of the proposed project activity.

4.5 ADDITIONALITY

4.5.1 Identification of alternatives

According to ACM0002 version 15.0, identifying alternative scenarios to the project activity only applies to retrofit, rehabilitation, or replacement of existing power plants and not Greenfield power plants. As a result, the Project Plan did not include alternative scenarios which is in line with the “Tool for the demonstration and assessment of additionality”, version 7.0.0 (Tool version 7.0.0). The baseline scenario applicable to the project activity is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants.

4.5.2 Investment analysis

4.5.2.1 Choice of approach

The project proponent selected the investment analysis to demonstrate additionality. The project proponent carried out the investment analysis using the Tool version 7.0.0 and the “Guidelines on the assessment of investment analysis” (Guidelines version 5.0). Simple cost analysis and investment comparison analysis are not applicable for the project activity because the proposed project generates economic benefits apart from the carbon credit income (i.e. the sale of electricity). In addition, the baseline scenario is the continuation of the current situation (the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants) and does not involve any investment. Therefore, the project proponent selected Tool version 7.0.0, Section 4.3.4, sub-step 2b: option III: “Apply benchmark analysis” as the investment analysis method.

The project proponent selected an approach of using a weighted average capital cost (WACC) as a suitable financial indicator for the project internal rates of return (IRR), and established the benchmark in accordance with the Guidelines, version 5.0. RCE confirmed that the WACC benchmark analysis was fitting and relevant for comparable renewable energy projects in Brazil.

4.5.2.2 Benchmark selection

The project proponent calculated the WACC for comparative renewable energy projects in Brazil to be 9.25%. The results represented an IRR with a more conservative opportunity cost than what currently exists in the Brazilian renewable energy market. RCE confirmed that the methodology used was in accordance with the Guidelines version 5.0, and that all the assumptions and calculations used are valid.

RCE also confirmed the calculation spreadsheet used for the benchmark and investment analysis are free from errors or omissions.

4.5.2.3 Input parameters

RCE validated all input parameters used for investment analysis presented in the PD, investment analysis, and benchmark analysis calculation spreadsheets.

Input parameters used in the investment analysis:

- Revenue: energy exported to the grid (MWhr) X Energy Price (BRL/MWhr)
- Capital cost: actual capital expenditures
- Operating costs:
 - O&M contract cost: based on negotiated cost per turbine and number of turbines
 - Taxes: sales tax (PIS/COFINS, TFSEE), social tax, income tax
 - Other fees: property lease, insurance, transmission cost, CCEE, ONS

Input parameters used in the benchmark analysis:

- After tax cost of debt – real:
 - Financial cost: average bank bond rates
 - BNDES spread: bank spread
 - Credit risk rate
 - Marginal tax rate
 - Inflation forecast
- Cost of equity – real:
 - Risk free rate: U.S. t-bills
 - U.S. expected inflation rate
 - Equity risk premium
 - Estimated country risk premium
 - Adjusted industry beta
- Weighted cost of capital:
 - Target debt / total capital
 - Target equity / total capital
 - After tax cost of debt – real
 - Cost of equity – real

4.5.2.1 Calculation and Comparison

The project proponent compared the benchmark IRR to each of the four wind power plants in order to determine and compare the profitability of investments. The project activity's IRR ranged from 3.6% -6.8% without revenue from emission reduction credits. RCE confirmed the project proponent calculated WACC and IRRs correctly and free from errors, and submitted a clear comparison of the financial indicators that showed the project activity IRR was less favorable than the benchmark IRR of 9.25%.

4.5.3 Sensitivity analysis

Power generation, power price and capital investment are the economic parameters that most influence the financial analysis of the projects. The uncertainty in these values is considered minimal where power supply, cost and investment are either contracted or already realized (investment). The project proponent used the following methods of sensitivity analysis: variation of power generated in conjunction with

power price up 10% from the project case as well as the investment down 10%. Table 3 shows the result of the sensitivity analysis. None of the sensitivity changes result in an IRR greater than the benchmark IRR of 9.25%.

Table 3 – Sensitivity Analysis 1

| SCENARIO 1: 10% IN ALL PARAMETERS | IRR % | | | |
|------------------------------------|-------------|--------------|---------|--------|
| | Mar e Terra | Areia Branca | Embuaca | Icaraí |
| Original | 3.64% | 6.75% | 6.66% | 5.60% |
| Increase in electricity generation | 4.87% | 8.06% | 7.98% | 6.89% |
| Increase in the tariff | 4.87% | 8.06% | 7.98% | 6.89% |
| Reduction in project investment | 4.97% | 8.18% | 8.09% | 7.00% |

The second sensitivity analysis determined what was the value of the parameter needed in order to match the benchmark IRR. Table 4 shows the results of this analysis for each project site.

Table 4 – Sensitivity Analysis 2

| SCENARIO MAR E TERRA: Reaching the Benchmark | IRR % | PRICE (BRL/MWh) | COST (1,000BRL) | ELECTRICITY (MWh/yr) | Variation (%) |
|---|-------|--------------------|--------------------|-------------------------|------------------|
| Original | 3.64% | 152.64 | 98,445.00 | 72,708 | N/A |
| Price | 9.25% | 231.00 | 98,445.00 | 72,708 | 51.34% |
| Investment | 9.25% | 152.64 | 64,580.00 | 72,708 | 52.44% |
| Electricity | 9.25% | 152.64 | 98,445.00 | 110,056 | 51.37% |

| SCENARIO AREIA BRANCA: Reaching the Benchmark | IRR % | PRICE (BRL/MWh) | COST (1,000BRL) | ELECTRICITY (MWh/yr) | Variation (%) |
|--|-------|--------------------|--------------------|-------------------------|------------------|
| Original | 6.75% | 152.63 | 111,820.00 | 102,492 | N/A |
| Price | 9.25% | 182.50 | 111,820.00 | 102,492 | 19.57% |
| Investment | 9.25% | 152.63 | 93,300.00 | 102,492 | 19.85% |
| Electricity | 9.25% | 152.63 | 111,820.00 | 122,500 | 19.52% |

| SCENARIO EMBUACA: Reaching the Benchmark | IRR % | PRICE (BRL/MWh) | COST (1,000BRL) | ELECTRICITY (MWh/yr) | Variation (%) |
|---|-------|--------------------|--------------------|-------------------------|------------------|
| Original | 6.66% | 151.07 | 111,433.00 | 97,236 | N/A |
| Price | 9.25% | 181.70 | 111,433.00 | 97,236 | 20.28% |
| Investment | 9.25% | 151.07 | 92,350.00 | 97,236 | 20.66% |
| Electricity | 9.25% | 151.07 | 111,433.00 | 116,960 | 20.28% |

| SCENARIO ICARAÍ: Reaching the Benchmark | IRR % | PRICE (BRL/MWh) | COST (1,000BRL) | ELECTRICITY (MWh/yr) | Variation (%) |
|---|-------|-----------------|-----------------|----------------------|---------------|
| Original | 5.60% | 151.08 | 79,486.00 | 68,328 | N/A |
| Price | 9.25% | 196.70 | 79,486.00 | 68,328 | 30.20% |
| Investment | 9.25% | 151.08 | 60,817.00 | 68,328 | 30.70% |
| Electricity | 9.25% | 151.08 | 79,486.00 | 88,930 | 30.15% |

These results show that the percent change in the relative parameter ranges from 20 to 52 percent which is significantly above expected level of uncertainty.

4.5.3.1 Barrier analysis

The application of the investment analysis demonstrated the additionality of the project, thus no barrier analysis is required.

4.5.3.2 Common practice analysis

Common practice analysis determines the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. According to “Tool for the demonstration and assessment of additionality” version 07.0.0, Section 4.5, the selection of Sub-step 4a or 4b is based on whether the proposed project activity applies “measures” that are listed in Section 3.0 – Definitions. RCE confirmed that Greenfield power plants do not apply to the following four measures covered in the framework:

- (i) Fuel and feedstock switch (example: switch from naphtha to natural gas for energy generation, or switch from limestone to gypsum in cement clinker production);
- (ii) Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy);
- (iii) Methane destruction (example: landfill gas flaring);
- (iv) Methane formation avoidance (example: use of biomass that would have been left to decay in a solid waste disposal site resulting in the formation and emission of methane, for energy generation).

As a result, the project proponent selected Sub-step 4b, which is in close alignment with ACR’s common practice test, and the test outlined in the “Guidelines on common practice, version 2.0” does not apply (for Sub-step 4a only).

The project proponent provided an analysis that demonstrated to which extent similar activities to the proposed project activity have been implemented previously or are currently underway in Brazil. Similar activities were defined for similar scale projects, taking place in a comparable environment, inter alia, with respect to the regulatory framework and are undertaken in the applicable geographical area (defined as the country of Brazil). The project proponent provided documented evidence and, where relevant,

quantitative information. According to ANEEL, electricity generation from wind power plants represented 3.6%⁶ of Brazil's electricity supply in 2014.

The project proponent established the start date of June 23, 2013 as the basis of the initial common practice test. Similar activities to the proposed project activity were then compared to the proposed project activity and assessed whether there are essential distinctions between the proposed project activity and the similar activities. The project proponent screened the similar activities for essential distinctions such as: project scale, financial benefits such as CDM participation, and renewable energy incentives (PROINFA). Finally, 10 of the 11 similar projects to the proposed project activity were financed and operated by public sector utilities in Brazil.

RCE confirmed that all wind power plants of MS Renováveis Complex are owned by MS Renováveis, which is a private sector entity, and agree, as per the analysis presented by the project proponent, that the project activity was not common practice at the time of the project start date.

4.6 REGULATORY SURPLUS

The regulatory surplus test includes existing laws, regulations, statutes, legal rulings, or other regulatory frameworks that directly or indirectly affect GHG emissions associated with the project activity. RCE confirmed that there are no mandatory laws and regulations requiring renewable energy power generation or GHG emissions limits for power generation in Brazil, and that the project was carried out in accordance to the applicable Brazilian laws and regulations according the following agencies:

- National Electric System Operator (ONS, from Portuguese, *Operador Nacional do Sistema Elétrico*);
- Electricity Regulatory Agency (ANEEL, from Portuguese, *Agência Nacional de Energia Elétrica*);
- Rio Grande do Norte Environmental Agency (IDEMA, from Portuguese, *Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte*);
- Ceará State Environmental Agency (SEMACE, from the Portuguese, *Superintendência Estadual do Meio Ambiente*).

4.7 ENVIRONMENTAL IMPACTS

The latest version of the project plan (June 2015) includes a comprehensive summary of the project activity's environmental aspects during its construction and operation phases. Related mitigation actions are also indicated in accordance with the project's environmental licensing documentation. RCE assessed these documents that GeoConsult prepared as part of the review.

As also described in the PD, the project proponents hold all required environmental permits to construct and operate the four wind farms encompassed by the project activity as shown in Table 5.

⁶ www.aneel.gov.br/aplicacoes/capacidadebrasil/capacidadebrasil.cfm

Table 5 – Dates of Wind Farm Operational Licenses

| PLANT | OPERATING LICENSE DATE OF ISSUANCE | EXPIRATION DATE |
|--------------|------------------------------------|-------------------|
| Mar e Terra | August 5, 2013 | August, 5, 2017 |
| Areia Branca | August 5, 2013 | August, 5, 2017 |
| Embuaca | November 18, 2013 | November 17, 2017 |
| Icaraí | February 26, 2013 | February 25, 2017 |

Rio Grande do Norte State in Brazil (Instituto de Desenvolvimento Sustentável e Meio Ambiente do Rio Grande do Norte – IDEMA), and SEMACE (from Portuguese, *Superintendência Estadual do Meio Ambiente* – Ceará – State Superintendent of Environment). RCE confirmed they are competent environmental authorities who reviewed and approved the submitted documents for the performed assessment to identify the environmental impacts for the four wind farms.

In summary, the validation team confirmed that the project activity is not expected to promote significant negative environmental impacts. The validation team was also able to confirm that the environmental licensing process for the four wind farms encompassed by the project activity has so far followed all applicable requirements and procedures for assessing and addressing environmental impacts as established by applicable environmental regulations.

4.8 LOCAL STAKEHOLDERS CONSULTATION

The project proponent initially presented the project as a Clean Development Mechanism project. However, the stakeholder's letters for this initial process were not available; instead, the project proponent presented the results of environmental impact assessments conducted by GeoConsult (and approved by IDEMA), and consent letters from the three municipalities' governments involved. RCE reviewed the evidences and found them to be sufficient documentation of the local consultation process. RCE reviewed a PowerPoint presentation that summarized the Environmental Impact Reports and was used at public hearings in Ceará. Public hearings were held in Embuaca on May 2, 2011, and in Icaraí on August 31, 2011.

4.9 PROJECT PLAN

The GHG Project Plan for the project activity "MS Renováveis Wind Power Complex: Mar e Terra, Areia Branca, Embuaca and Icaraí" submitted by MS Renováveis and Embrasca is the basis for much of the validation activities. The final version is dated June 2015. RCE confirmed that the Project Plan is based on the currently valid ACR GHG Project Plan template version 1.0, and is completed in accordance with ACR Standard 3.0

4.10 MONITORING PLAN, DATA MANAGEMENT SYSTEMS, QA/QC

The project utilizes the approved baseline and monitoring methodology ACM0002, "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 15.0. RCE confirmed the monitoring plan is in accordance with the monitoring methodology and will provide real measurements of achieved emission reductions. RCE has checked all the parameters presented in the monitoring plan and found no deviations relevant to the project activity against the requirements of the methodology. RCE confirms that the data management and QA/QC procedures described in the monitoring plan are reasonable within the project design, and the implementation of the monitoring plan is sufficient evidence to ensure the ex-ante emission reductions resulting from the project activity can be reported ex-post and verified.

The baseline emission factor is determined and fixed ex-ante according to the methodological tool "Tool to calculate emission factor for an electricity system" version 4.0. The project proponent used the most recent information available to calculate the combined margin emission factor documented in the Project Plan submitted to ACR. The ex-post parameter included in the Project Plan is in compliance with the methodology, and it will be monitored during the crediting period as " $EG_{\text{facility},y}$ - Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)".

The project will monitor electricity dispatched by the wind farms using official measurements in accordance with the procedures established by the Chamber of Electric Energy Commercialization (CCEE). The project meters electricity at substations located at the wind farms as it flows through a transmission line and undergoes a new meter at the point where the electricity enters the electricity grid system. All meters are bidirectional with an accuracy of $\pm 0.2\%$ and measures the generation information every five minutes. CCEE automatically records this data by measuring electricity at the exit of the wind farm and at the substations. CCEE is responsible for calculating any line losses related to the transmission lines from the wind farms to the electricity grid system.

The monitoring plan QA/QC procedures to cross check measurement results are in line with the applied methodology, ACM0002. Data will be kept secure for a minimum of two years following the end of the relevant crediting period, in accordance with the ACR Standard 3.0 and the applied methodology, ACM0002.

4.11 PROJECT START DATE

During the site visit, RCE confirmed the project is a Greenfield project and therefore no project activity was occurring prior to the start date. Using the wind farms testing data and electricity sales records, RCE confirmed the start date for the project is June 29, 2013.

4.12 OFFSET TITLE

The electricity sales agreement for the project activity do not mention ownership of any environmental attributes from the renewable energy. However, the ACR Standard 3.0 states "governments of developing countries (non-Annex 1) by approving emission reduction projects from renewable energy projects, provide a de facto assignment of emission reduction property rights to project Proponents instead of owners of fossil fuel power plants." Further, "All emission reductions generated by the project activity are attributable to activities controlled by the project proponent."

The project proponent, MS Renováveis Participações Societária S.A., provided RCE an Attestation of Title stating there are no competing claims for the emission reductions. As a result, RCE confirmed that MS Renováveis Participações Societária S.A. provided adequate evidence of ownership of the wind farm power plants through an attestation of undisputed title to all offsets, and a lack of any competing environmental credit opportunities in Brazil.

4.13 ESTIMATED EMISSION REDUCTIONS

Regarding the ex-ante emission reductions forecast, Project Plan, and Calculator; the Ministry of Science and Technology publishes the Emission Factors for the Brazilian Interconnect System on the following homepage <http://www.mct.gov.br/index.php/content/view/74689.html>. The project proponent applied these factors and provided detailed calculations via an Excel Spreadsheet. Table 6 summarizes the expected annual and total emission reductions by wind power plant.

Table 6 – Ex-ante Forecast of Emission Reductions

| <i>Ex Ante Forecast of Emission Reductions - June 29, 2013 - June 28, 2020</i> | | | | | |
|---|--------------------|---------------------|----------------|----------------|----------------|
| | Mar e Terra | Areia Branca | Embuca | Icaraí | Total |
| 2013 (6/29-12/31) | 14,698 | 20,719 | 19,657 | 13,813 | 68,888 |
| 2014 | 29,000 | 40,879 | 38,783 | 27,253 | 135,914 |
| 2015 | 29,000 | 40,879 | 38,783 | 27,253 | 135,914 |
| 2016 | 29,000 | 40,879 | 38,783 | 27,253 | 135,914 |
| 2017 | 29,000 | 40,879 | 38,783 | 27,253 | 135,914 |
| 2018 | 29,000 | 40,879 | 38,783 | 27,253 | 135,914 |
| 2019 | 29,000 | 40,879 | 38,783 | 27,253 | 135,914 |
| 2020 (1/1-6/28) | 14,262 | 20,104 | 19,073 | 13,403 | 66,843 |
| TOTAL (tCO₂e) | 202,958 | 286,097 | 271,426 | 190,732 | 951,213 |
| ANNUAL AVERAGE (tCO₂e) | | | | | 135,888 |

5 UNCERTAINTY ASSESSMENT

MS Renováveis Wind Power Project: Mar e Terra, Areia Branca, Embuaca and Icarai

Validation Sampling Plan

Risk Assessment

| Identified areas of risk: | Reason that risk exists | Inherent Risk (high, med, low) | Control (high, med, low) | Detection Risk (high, med, low) | Status | How Risk is addressed and alleviated |
|--|---|-----------------------------------|-----------------------------|------------------------------------|--------|---|
| Baseline Scenario | Confirm all power plants physically connected to the electric grid | Low | Low | Lowest | Closed | No alternative baseline assessment required. Physical connections to grid confirmed during the site visit and evidences provided. |
| Start Date | Confirm the date the Project began to reduce GHG emissions | Medium | Medium | Medium | Closed | Project developer provided contractual documents and operational data to confirm start date. |
| Additionality | Project must exceed regulatory surplus, common practice, and financial barriers test | High | High | Highest | Closed | MS Renovaveis provided attestation of offset title |
| GHG Boundry | Confirm all SSRs are included | Low | Medium | Lower | Closed | SSRs confirmed during the site visit. |
| Meeting the program requirements | Project must meet all ACR requirements | Medium | High | Higher | Closed | MS Renovaveis provided attestation of offset title |
| Quantification Methodology | Project must follow ACM0002 | Low | Medium | Lower | Closed | Brazil electric grid factor confirmed. |
| Monitoring & Metering | Confirm monitoring follows the Project Plan. No Monitoring Report provided. | Medium | Medium | Medium | Closed | Project developer provided monitoring plan and report for each wind farm. |
| Language or cultural barriers | Lead Validator does not understand Portuguese language; many support documents in Portuguese | High | Medium | Higher | Closed | Project developer and RCE validation team member are fluent in Portuguese and English |
| Likelihood the planned project could reasonably be expected to achieve the claimed emission reductions | Need to confirm that the site-specific conditions of the planned project represent the information contained in the project plan. | Low | Low | Lowest | Closed | Project has been in operation for nearly 2 years and ex-ante emissions estimates based on real kW-hr data. Low uncertainty with elec EF since it's published by Brazil gov't. ACM0002 calculations are relatively simple. |

Inherent risk: risk that errors (or misstatements or deviations) will occur - Project developer controlled

Control risk: risk that Project developer's internal control system will fail to prevent/detect/correct errors - Project developer controlled

Detection risk: risk that the verifier's procedures will fail to detect errors - Verifier controlled

6 ISSUES AND RESOLUTIONS

Material Findings:

| Action Item | Resolution | Status |
|---|--|---|
| 1. Provide a detailed Monitoring Plan (outside of Project Plan) for the project that includes a project diagram, location and type of monitoring/metering equipment, calibration requirements, data control, recordkeeping, QA/QC procedures, roles and responsibilities. | January 21, 2015: Embrasca provided separate Monitoring Plans for each wind farm including Areia Branca, Mar e Terra, Embuaca, and Icarai. | <input checked="" type="checkbox"/> Addressed <input type="checkbox"/> Pending |
| 2. Provide Environmental Assessment that was completed for the transmissions lines constructed from the wind power complexes to the electric grid substation. Also, include a summary of the community & environmental impacts in the Project Plan. | January 21, 2015: Embrasca provided Environmental Assessment documentation for the transmission lines. March 2, 2015: The EA was updated and mentioned in Sec F.1. of Project Plan. | <input checked="" type="checkbox"/> Addressed <input type="checkbox"/> Pending |
| 3. The Investment Analysis spreadsheet provided contains incorrect links on the Icarai and sensitivity tabs. | May 11, 2015: Embrasca provided revised calculated values in cells E5 – E8 on the ‘Sensitivity Analysis’ tab in the updated Investment Analysis spreadsheet. | <input checked="" type="checkbox"/> Addressed <input type="checkbox"/> Pending |
| 4. Provide documentation and attestation of undisputed title to all offsets generated by the project. | June 1, 2015: Embrasca provided a signed attestation of title document which is to be updated annually. | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |

Non-Material Findings:

| Action Item | Resolution | Status |
|--|---|--|
| 1. Modify Table A.4 in the Project Plan to correctly reflect the model types of wind turbines deployed at Mar e Terra and Embuaca complexes. | January 21, 2015: Table A.4 of the the revised Project Plan dated January 15, 2015 correctly reflects the number and model types of the wind turbines. | <input checked="" type="checkbox"/> Addressed <input type="checkbox"/> Pending <input type="checkbox"/> Ignore |

Additional Documentation:

| Action Item | Resolution | Status |
|--|--|--|
| 1. Provide additional support documentation from electricity | January 21, 2015: Embrasca provided additional documentation for the power generation test period for each of the | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |

| | | |
|--|--|--|
| generation records that confirm start date. | wind farms. RCE confirms the project start date to be June 29, 2013. | |
| 2. Provide qualifications of GeoConsultant who conducted environmental assessment. | January 21, 2015: Embrasca provided the qualifications of the firm who conducted the Environmental Assessment for the wind turbines and transmission lines. | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |
| 3. Provide further evidence of stakeholder meeting invitations, public hearing dates, presentations given, and response letters (if any). | January 21, 2015: Embrasca provided publications and documentation of the stakeholder engagement process. | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |
| 4. Provide source documentation (and links) in Benchmark Analysis spreadsheet for WACC calculation assumptions; specifically for BNDES Spread, marginal tax rate, estimated country risk premium, and target debt. | April 14, 2015: Embrasca provided a revised Investment Analysis spreadsheets with correct hyperlinks and a summary tab that linked the parameters to identified file names and locations in the source documentation | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |
| 5. Provide source documentation (and links) in Investment Analysis spreadsheet for IRR calculation assumptions, similar to sources cited in Table C.6 in Project Plan. April 15, 2015: Provide links to source documentation for the tax values and insurance investment used in the analysis. | March 15, 2015: Embrasca provided a revised Investment Analysis spreadsheets with correct hyperlinks and a summary tab that linked the parameters to identified file names and locations in the source documentation. May 12, 2015: Embrasca provided evidence for the tax values used. May 29, 2015: Embrasca provided evidence for the insurance premiums used in the analysis. | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |
| 6. Provide an updated ERT calculation spreadsheet using the revised assured energy values that match the PD. | May 13, 2015: Embrasca provided the updated ERT calculation spreadsheet. | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |
| 7. The coordinated for the 13 th wind mill at the Areia Branca wind power plan are missing in the PD. | June 22, 2015: Embrasca updated the PD with the correct coordinates for the 13 th wind mill. | <input checked="" type="checkbox"/> Received <input type="checkbox"/> Pending |

Clarifications:

| Action Item | Resolution | Status |
|---|---|--|
| 1. Explain why common practice research that was conducted in ANEEL online database was limited to Southern Brazil (as stated in Project Plan). Table C.1 in Project Plan appears to include projects throughout Brazil. Justify the use of Sub-step 4a from the methodological tool for the demonstration and assessment of additionality V.7.0.0. | <p>January 29, 2015: Embrasca clarified the mention in the PP was a typo and analysis was conducted country wide.</p> <p>April 15, 2015: Embrasca provided a revised common practice analysis spreadsheet using Sub-step 4b (following discussions with ACR), and an updated Project Plan containing the new information.</p> | <input checked="" type="checkbox"/> Addressed <input type="checkbox"/> Pending <input type="checkbox"/> Ignore |
| 2. Were all Brazil renewable energy incentives included in the financial barriers assessment? | December 10, 2014: Embrasca explained how the 3.65% equipment tax exemption was already accounted for in the capex calculations. | <input checked="" type="checkbox"/> Addressed <input type="checkbox"/> Pending <input type="checkbox"/> Ignore |
| 3. Explain why transmission costs are not included in the Investment Analysis (row 19 in spreadsheet). | April 14, 2015: Embrasca provided a revised Investment Analysis spreadsheets with correct equations. | <input checked="" type="checkbox"/> Addressed <input type="checkbox"/> Pending <input type="checkbox"/> Ignore |

7 VALIDATION CONCLUSION

This validation of the MS Renováveis Wind Power Complex: Mar e Terra, Areia Branca, Embuaca, and Icarai Project Plan was completed in a manner consistent with ISO 14064-3 and in conformance to the ACR Standard, Version 3.0 and the ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, Version 15.0 (June 1, 2014) including the Project Plan, baseline, additionality, monitoring and reporting procedures, and quality assurance/quality control (QA/QC) procedures; reductions/removal enhancements, leakage assessment, and impermanence risk assessment and mitigation.



Michael Coté, Lead Validator



Bonny Crews, Peer Reviewer

Appendix A – Document Review

ACR GHG Project Plan Eligibility Screening_MS Renovaveis_Wind
completes_3rd review.pdf

MS Renovaveis Benchmark Analysis.xlsx

MS Renovaveis ERT Calculations.xlsx

MS Renovaveis Investment Analysis.xlsx

MS Renovaveis Nov 14.pdf

MS Renovaveis Out 14.pdf

Common Practice MS Renovaveis FINAL.xlsx

MS Renovaveis Benchmark Analysis FINAL.xlsx

Areia Branca_RAS - Planos de Controle.pdf

Embuaca_EIA - Planos de Controle.pdf

Icarai_EIA - Planos de Controle.pdf

Embuaca_LO.pdf

Icarai_LO.pdf

Mar e Terra_LO.pdf

Areia Branca_LO.pdf

Icarai_EIA - Impactos Ambientais.pdf

Mar e Terra_RAS - Impactos Ambientais.pdf

Areia Branca_RAS - Impactos Ambientais.pdf

Embuaca_EIA - Impactos Ambientais.pdf

Despacho Num 4774 22Dez09.pdf

Res ANEEL 907 Nov 10 2009.pdf

Auction Results Dec 14 2009.pdf

Anuencia Icarai.pdf

Anuencia Mar e Terra.pdf

Anuencia Prefeitura de Trairí_UEE Embuaca.pdf

Audiência Pública Embuaca.PDF

Audiência Publica Icarai.PDF

Anuencia Areia Branca.pdf

Anuencia Embuaca.pdf

Mar e Terra_PIE.pdf

Areia Branca_PIE.pdf

Embuaca_PIE.pdf

Icarai_PIE.pdf

Embuaca_Despacho 794 - ANEEL.pdf

Icarai_Despacho 2022 - ANEEL (DOU).pdf

Mar e Terra_Despacho 356 - ANEEL.pdf

Areia Branca_Despacho 357 - ANEEL.pdf

Vidas Uteis - MS.xlsx

Icarai_PIE.pdf

Mar e Terra_PIE.pdf
Areia Branca_PIE.pdf
Embuaca_PIE.pdf
Comissioning Reports Embuaca.rar
Comissioning Reports Areia Branca and Mar e Terra.rar
Comissioning Reports Icaraí.rar
Suzlon-S88.pdf
Contrato Concessão e Uso Embuaca.pdf
Contrato Concessão e Uso Icaraí.pdf
Contrato Concessão e Uso Mar e Terra.pdf
Licença_IDEMA_Mar e Terra_Licença de Operação_20130805.pdf
Licença_Semace_Icaraí_Licença de Operação LT 69kV_20120215.pdf
13.08.29 Licença_IDEMA_LT 230kV - MT e BV_Licença de
Operação.pdf
AGE ELEIÇÃO DIRETORIA 2015 MT.pdf
AGE_BV_Reeleição Diretoria_20140201.pdf
AGE_EMB_Reeleição Diretoria_20140201.pdf
AGE_ICA_Reeleição Diretoria_20140201.pdf
AGE_MT_Reeleição Diretoria_20140201.pdf
Contrato Concessão e Uso Areia Branca.pdf
MS Renovaveis Nov 14.pdf
MS Renovaveis ERT Calculations.xlsx
MS Renovaveis Investment Analysis.xlsx
MS Renovaveis Benchmark Analysis.xlsx
MS Renovaveis Common Practice.xls
Planilha_Comar_Mar Terra_Coordenadas Cotas_20120313.xls
MS Renovaveis June 2015.pdf
Planilha_Comar_Bela Vista_Coordenadas Cotas_20120313.xls
Planilha_Comar_Embuaca_Coordenadas Cotas_20120313.xls
Planilha_Comar_Icaraí_Coordenadas Cotas_20120313.xls
MS Renovaveis ERT Calculations March15.xlsx
MS Renovaveis Investment Analysis May15.xlsx
MS Renovaveis May 15.pdf
Common Practice MS Renovaveis FINAL.xlsx
Evidence List GHG PP MS Renovaveis Reviewed.xlsx
MS Renovaveis Benchmark Analysis FINAL.xlsx
Icarai Control Plans.pdf
AB&MT Control Plans.pdf
Embuaca Control Plans.pdf
Icarai_LO.pdf
Mar e Terra_LO.pdf
Areia Branca_LO.pdf
Embuaca_LO.pdf

Embuaca_TL_LO.pdf
Icarai_TL_LO.pdf
Areia Branca and Mar e Terra_TL_LO.pdf
Mar e Terra_RAS - Environmental Impacts.pdf
Areia Branca_RAS - Environmental Impacts.pdf
Embuaca_EIA - Environmental Impacts.pdf
Icarai_EIA - Environmental Impacts.pdf
Mar e Terra Qualifications.pdf
Areia Branca Qualifications.pdf
Embuaca Qualifications.pdf
Icarai Qualifications.pdf
Chapter 07 ENV AB&MT TL1.pdf
Chapter 07 ENV AB&MT TL2.pdf
Chapter 05 ENV AB&MT TL1.pdf
Chapter 05 ENV AB&MT TL2.pdf
Chapter 06 ENV AB&MT TL1.pdf
Chapter 06 ENV AB&MT TL2.pdf
Chapter 06 ENV EMB TL.pdf
Chapter 07 ENV EMB TL.pdf
Chapter 05 ENV EMB TL.pdf
Chapter 07 ENV ICA TL.pdf
Chapter 05 ENV ICA TL.pdf
Chapter 06 ENV ICA TL.pdf
Target Debt.pdf
Auction Contract MT.pdf
Auction Contract AB.pdf
Auction Contract EMB.pdf
Auction Contract ICA.pdf
CCEE Fee MT.pdf
CCEE Fee AB.pdf
CCEE Fee Emb.pdf
CCEE Fee ICA.pdf
Federal Income Taxes.pdf
Installed Capacity MT.pdf
Installed Capacity AB.pdf
Installed Capacity EMB.pdf
Installed Capacity ICA.pdf
Insurance MT 01.pdf
Insurance MT 02.pdf
IMG_19052015_174444.png
Insurance AB 01.pdf
Insurance AB 02.pdf
Insurance Calculations MS.xlsx

Insurance EMB 01.pdf
Insurance EMB 02.pdf
Investment BNDES MT.pdf
Investment BNB AB.pdf
Investment BNB EMB.pdf
Investment BNB MT.pdf
Investment BNDES AB.pdf
Investment BNDES EMB.pdf
Investment BNDES ICA.pdf
Lease Contract MT.pdf
Lease Contract AB.pdf
Lease Contract EMB.pdf
Lease Contract ICA.pdf
O&M MT.pdf
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O&M EMB.pdf
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TUST EMB_01.pdf
TUST EMB_02.PDF
TUST ICA_01.pdf
TUST ICA_02.pdf
TUST MT_01.pdf
Trairi Cityhall Letter.pdf
Amontada Cityhall Letter.pdf
Areia Branca Cityhall Letter.pdf
Embuaca Public Hearing.PDF
Environmental Presentation MS Renovaveis Dec14.pptx
Icarai Public Hearing.PDF
AGE_MT_Reeleição Diretoria_20140201.pdf
AGE ELEIÇÃO DIRETORIA 2015 MT.pdf
AGE_BV_Reeleição Diretoria_20140201.pdf
AGE_EMB_Reeleição Diretoria_20140201.pdf
AGE_ICA_Reeleição Diretoria_20140201.pdf
Contrato Concessão e Uso Mar e Terra.pdf
Contrato Concessão e Uso Areia Branca.pdf
Contrato Concessão e Uso Embuaca.pdf

Contrato Concessão e Uso Icaraí.pdf
Planilha_Comar_Mar Terra_Coordenadas otas_20120313.xls
Planilha_Comar_Bela Vista_Coordenadas Cotas_20120313.xls
Planilha_Comar_Embuaca_Coordenadas Cotas_20120313.xls
Planilha_Comar_Icaraí_Coordenadas Cotas_20120313.xls
RIMA EMBUACA.pdf