**Monitoring report form for CDM project activity**

**(Version 06.0)**

*Complete this form in accordance with the instructions attached at the end of this form.*

| **MONITORING REPORT** | | |
|---|---|---|
| **Title of the project activity** | Grid connected electricity generation from renewable source: Windfarm Complex Santa Vitória do Palmar and Chuí | |
| **UNFCCC reference number of the project activity** | 8012 | |
| **Version number of the PDD applicable to this monitoring report** | 4 | |
| **Version number of this monitoring report** | 02 | |
| **Completion date of this monitoring report** | 12/07/2017 | |
| **Monitoring period number** | 1 | |
| **Duration of this monitoring period** | 01st January 2015 to 15th April 2016 | |
| **Monitoring report number for this monitoring report** | N/A | |
| **Project participants** | Santa Vitória do Palmar Holding S.A.<br>Chuí Holding S.A.<br>WayCarbon Soluções Ambientais e Projetos de Carbono Ltda. | |
| **Host Party** | Federative Republic of Brazil | |
| **Sectoral scopes** | 01 – Energy industry (renewable source) | |
| **Applied methodologies and standardized baselines** | ACM0002 - Consolidated baseline methodology for grid-connected electricity generation from renewable sources (version 12.2.0) | |
| **Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period** | Amount achieved before 1 January 2013 | Amount achieved from 1 January 2013 |
| | 0 tCO2e | 632,797 |
| **Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD** | 795,064 tCO2e | |

## SECTION A. Description of project activity

### A.1. General description of project activity

The project activity consists in the implementation and operation of the Windfarm Complex Santa Vitória do Palmar and Chuí, constituted by 16 wind electricity generation facilities (Chuí I, Chuí II, Chuí IV, Chuí V, Minuano I, Minuano II, Verace I, Verace II, Verace III, Verace IV, Verace V, Verace VI, Verace VII, Verace VIII, Verace IX and Verace X[1]) (Table 1), located in Santa Vitória do Palmar and Chuí Municipalities, in the Rio Grande do Sul State, Brazil. The project activity employs 201 horizontal-axis aerogenerators (model Gamesa G97), each with 2.0 MW (total nominal capacity: 402.0 MW).

**Table 1:** Windfarm Complex Santa Vitória do Palmar and Chuí's facilities.

| Facility | Aerogenerators' Model | Quantity of Aerogenerators | Installed Capacity(MW) | Electricity generation (MWh/year) | Plant load factor | Net capacity (MW) |
|---|---|---|---|---|---|---|
| Chuí I | Gamesa G97 | 12 | 24.0 | 98,319 | 46.8% | 11.2 |
| Chuí II | | 11 | 22.0 | 87,089 | 45.2% | 9.9 |
| Chuí IV | | 11 | 22.0 | 86,620 | 44.9% | 9.9 |
| Chuí V | | 15 | 30.0 | 119,148 | 45.3% | 13.6 |
| Minuano I | | 11 | 22.0 | 82,999 | 43.1% | 9.5 |
| Minuano II | | 12 | 24.0 | 90,234 | 42.9% | 10.3 |
| Verace I | | 10 | 20.0 | 77,643 | 44.3% | 8.9 |
| Verace II | | 10 | 20.0 | 75,691 | 43.2% | 8.6 |
| Verace III | | 13 | 26.0 | 100,809 | 44.3% | 11.5 |
| Verace IV | | 15 | 30.0 | 120,407 | 45.8% | 13.7 |
| Verace V | | 15 | 30.0 | 113,634 | 43.2% | 13.0 |
| Verace VI | | 9 | 18.0 | 69,280 | 43.9% | 7.9 |
| Verace VII | | 15 | 30.0 | 116,339 | 44.3% | 13.3 |
| VeraceVIII | | 13 | 26.0 | 98,667 | 43.3% | 11.3 |
| Verace IX | | 15 | 30.0 | 115,727 | 44.0% | 13.2 |
| Verace X | | 14 | 28.0 | 110,787 | 45.2% | 12.6 |

The project activity is projected to deliver an average of 1,563,393 MWh/year[2] of renewable electricity to the National Interconnected System (*Sistema Interligado Nacional* - SIN). In the baseline[3], electricity delivered to the grid by the project activity would have 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. Hence, the project activity promotes GHG emissions reductions by displacing fossil fuel-based electricity generation that would otherwise occur.

[1] There are several names representing the same facilities and companies that compound the project activity. In the results of the 12th Brazilian Auction of New Energy (*12º Leilão de Energia Nova - Leilão nº 02/2011*), the facilities were named as Chuí I, Chuí II, Chuí IV, Chuí V, Minuano I, Minuano II, Verace I, Verace II, Verace III, Verace IV, Verace V, Verace VI, Verace VII, Verace VIII, Verace IX and Verace X, as mentioned above in the PDD. Nevertheless, Chuí and Minuano facilities can be named as Chuí's facilities, as a set, since they are all located in Chuí Municipality; and the holding that owns these facilities is Chuí Holding S.A. Verace's facilities are owned by Santa Vitória do Palmar Holding S.A., since they are located in Santa Vitória do Palmar Municipality; additionally, Verace's facilities can be named also as Geribatu's facilities.

[2] Considering the plant load factors defined in Inova Energy's study for Verace's facilities and in EREDA's study for Chuí and Minuano's facilities. A detailed description of the plant load factor of the project activity is presented in footnote 2 of this Monitoring Report.

[3] The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

The project boundary includes $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. Project and leakage emissions are not expected.

## A.2. Location of project activity

Federative Republic of Brazil;
State: Rio Grande do Sul
Municipalities: Santa Vitória do Palmar and Chuí

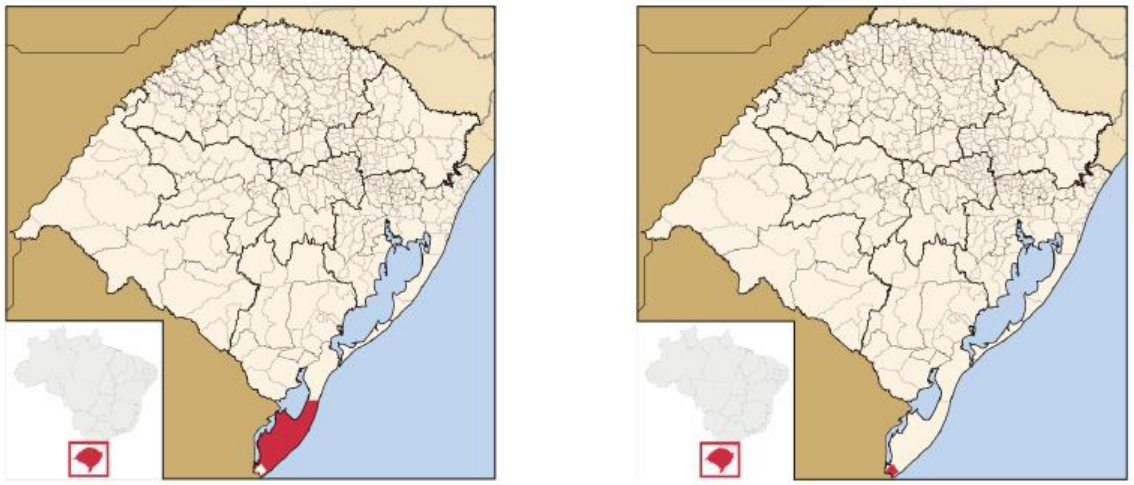

Figure 1. Geographic location of the project activity. Bottom-left panel in both figures: depicts the position of Rio Grande do SUl State in the Federetive Republic of Brazil. Main left panel: depicts Santa Vitória do Palmar Municipality within Rio Grande do Sul State. Main right panel: depicts Chuí Municipality within Rio Grande do Sul State.

The reference geographic coordinates of the project activity are depicted in Table 2.

**Table 2:** Project facilities' reference geographic coordinates.

| Facility | Type (Datum SIRGAS2000, 22S) | Latitude | Longitude |
|---|---|---|---|
| Chuí I | UTM | 6,272,978 m | 278,124 m |
| | Degrees | - 33°39'35".8261 | - 53°23'34".2523 |
| Chuí II | UTM | 6,272,638 m | 277,423 m |
| | Degrees | - 33°39'46".3286 | - 53°24'01".7541 |
| Chuí IV | UTM | 6,271,959 m | 276,022 m |
| | Degrees | - 33°40'07".2966 | - 53°24'56".7231 |
| Chuí V | UTM | 6,271,619 m | 275,322 m |
| | Degrees | - 33°40'17".7945 | - 53°25'24".1914 |
| Minuano I | UTM | 6,265,987 m | 277,429 m |
| | Degrees | - 33°43'22".0991 | - 53°24'07".5259 |
| Minuano II | UTM | 6,266,662 m | 276,662 m |
| | Degrees | - 33°42'59".6211 | - 53°24'36".6908 |
| Verace I | UTM | 6,291,509 m | 289,019 m |
| | Degrees | - 33°29'42".5793 | - 53°16'15".7864 |
| Verace II | UTM | 6,290,313 m | 288,112 m |
| | Degrees | - 33°30'20".7380 | - 53°16'51".9279 |
| Verace III | UTM | 6,288,498 m | 288,350 m |
| | Degrees | - 33°31'19".7952 | - 53°16'44".2549 |
| Verace IV | UTM | 6,285,283 m | 293,316 m |
| | Degrees | - 33°33'07".6087 | - 53°13'34".5595 |
| Verace V | UTM | 6,287,117 m | 286,656 m |
| | Degrees | - 33°32'03".3882 | - 53°17'51".0596 |
| Verace VI | UTM | 6,286,170 m | 288,608 m |
| | Degrees | - 33°32'35".5107 | - 53°16'36".2414 |

| | | | |
|---|---|---|---|
| Verace VII | UTM | 6,283,510 m | 291,543 m |
| | Degrees | - 33°34'03".8931 | - 53°14'44".7545 |
| Verace VIII | UTM | 6,285,104 m | 285,803 m |
| | Degrees | - 33°33'08".0836 | - 53°18'25".8421 |
| Verace IX | UTM | 6,282,745 m | 286,505 m |
| | Degrees | - 33°34'25".1257 | - 53°18'00".6700 |
| Verace X | UTM | 6,280,557 m | 290,986 m |
| | Degrees | - 33°35'39".3113 | - 53°15'08".8325 |

Sources:

- UTM: *Ficha de Dados EPE* (EPE's data sheet; EPE =*Empresa de Pesquisa Energética* = Brazilian Energetic Research Enterprise) (references: EPEDataSheet_Chui1; EPEDataSheet_Chui2; EPEDataSheet_Chui4; EPEDataSheet_Chui5; EPEDataSheet_Minuano1; EPEDataSheet_Minuano2; EPEDataSheet_Verace1; EPEDataSheet_Verace2; EPEDataSheet_Verace3; EPEDataSheet_Verace4; EPEDataSheet_Verace5; EPEDataSheet_Verace6; EPEDataSheet_Verace7; EPEDataSheet_Verace8; EPEDataSheet_Verace9; EPEDataSheet_Verace10).
- Degrees: conversion from UTM data by ProGrid Brazilian official program (program available at http://www.ibge.gov.br/home/geociencias/geodesia/param_transf/default_param_transf.shtm, accessed on 05/Dec/2011; conversion reference: ProGriD_0147_SIRGAS2000_Lat_Long_Chui1; ProGriD_0147_SIRGAS2000_Lat_Long_Chui2; ProGriD_0147_SIRGAS2000_Lat_Long_Chui4; ProGriD_0147_SIRGAS2000_Lat_Long_Chui5; ProGriD_0147_SIRGAS2000_Lat_Long_Minuano1; ProGriD_0147_SIRGAS2000_Lat_Long_Minuano2; ProGriD_0147_SIRGAS2000_Lat_Long_Verace01; ProGriD_0147_SIRGAS2000_Lat_Long_Verace02; ProGriD_0147_SIRGAS2000_Lat_Long_Verace03; ProGriD_0147_SIRGAS2000_Lat_Long_Verace04; ProGriD_0147_SIRGAS2000_Lat_Long_Verace05; ProGriD_0147_SIRGAS2000_Lat_Long_Verace06; ProGriD_0147_SIRGAS2000_Lat_Long_Verace07; ProGriD_0147_SIRGAS2000_Lat_Long_Verace08; ProGriD_0147_SIRGAS2000_Lat_Long_Verace09; ProGriD_0147_SIRGAS2000_Lat_Long_Verace10)

### A.3. Parties and project participants

| Parties involved | Project participants | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Federative Republic of Brazil (host) | Santa Vitória do Palmar Holding S.A.<br>Chuí Holding S.A.<br>WayCarbon Soluções Ambientais e Projetos de Carbono Ltda. | No |

### A.4. Reference to applied methodologies and standardized baselines

- ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 12.2.0.

- "Tool to calculate the emission factor for an electricity system". Latest approved version at the time of conclusion of this monitoring report: 05.5;

### A.5. Crediting period type and duration

Renewable, 01 Jan 15 – 31 Dec 21

## SECTION B. Implementation of project activity

### B.1. Description of implemented project activity

**Start date of the project activity: 09/08/2012**

The Project Starting Date only occurred after project registration. During the 12th Brazilian Auction of New Energy (*12º Leilão de Energia Nova - Leilão nº 02/2011*[4]), the wind electricity generation of this project activity was contracted; nevertheless, the Power Purchase Agreement (PPA) established in the auction did not commit the entrepreneurs to the wind electricity generation facilities' implementation, since it was still possible to sell the PPA to another part.

As of August 9, 2012, the entrepreneurs signed the first turn-key contract including Gamesa and Schahin for the implementation of VERACE I-X. This date defines the Starting Date of the project activity. The milestone is presented on Table 3 – Timeline for implementation of registered project activity.

**Timeline for implementation of registered project activity**

Table 3 – Timeline for implementation of registered project activity.

| Date | Object | Related part | Document reference | Observation |
|---|---|---|---|---|
| 09/08/2012 | Turn-key contracts signature for VERACE I-X implementation | GAMESA, Schahin | Contrato EPC - Geribatu X - EOL ST GB X 085 2012 // Contrato EPC - Geribatu VIII - EOL ST GB VIII 083 2012 // Contrato EPC - Geribatu VII - EOL ST GB VII 082 2012 // Contrato EPC - Geribatu VI - EOL ST GB VI 081 2012 // Contrato EPC - Geribatu V - EOL ST GB V 080 2012 // Contrato EPC - Geribatu IX - EOL ST GB IX 084 2012 // Contrato EPC - Geribatu IV - EOL ST GB IV 079 2012 // Contrato EPC - Geribatu III - EOL ST GB III 078 2012 // Contrato EPC - Geribatu II - EOL ST GB II 077 2012 // Contrato EPC - Geribatu I - EOL ST GB I 076 2012 | Entrepreneurs contracted Gamesa and Schahin for project implementation. |
| 23/11/2012 | Turn-key contracts signature for CHUI I,II,IV, V and Minuano I, II implementation | IMPSA, SCHAHIN | EOL CH CHVII 108 2012 CONSÓRCIO EPC // EOL CH CHV 144 2012 - CONSÓRCIO EPC // EOL CH CH VI 145 2012 - CONSÓRCIO EPC // EOL CH CH IV 143 2012 - CONSÓRCIO EPC // EOL CH CH II 142 2012 - CONSÓRCIO EPC // EOL CH CH I 141 2012 - CONSÓRCIO EPC | Entrepreneurs contracted IMPSA and Schahin for project implementation. |
| 24/09/2013 | Dissolution of turn-key contracts CHUI-IMPSA | IMPSA | `Termo de Acordo - IMPSA´ dated 7/02/2014 but entried into force in 24/09/2013 | As IMPSA could not deliver the contracted aerogenerators, the contract was terminated |

[4] 12th Brazilian Auction of New Energy (12º *Leilão de Energia Nova - Leilão nº 02/*2011).

| Date | Object | Related part | Document reference | Observation |
|---|---|---|---|---|
| 21/10/2013 | Turn-key contracts signature for CHUI IV, V and MINUANO I, II implementation | GAMESA, SCHAHIN | EOL CH CH VII 253 2013-253A1 EPC CHUI // EOL CH CH VI 252 2013-252A1 EPC CHUI // EOL CH CH V 251 2013-251A1 EPC CHUI // EOL CH CH IV 250 2013-250A1 EPC CHUI | After the IMPSA contract termination, a turn-key contract including GAMESA and SCHAHIN for the implementation was signed |
| 03/02/2014 | SCHAHIN cession of rights to PAVSOLO concerning turn-key contracts CHUI IV, V and MINUANO I, II | SCHAHIN, PAVSOLO, GAMESA | Aditivo aos EOLs 250 251 252 253 | A complimentary agreement was signed to formalize SCHAHIN´s cession of rights to PAVSOLO concerning the turn-key contracts for CHUI IV-V and MINUANO I, II |
| 12/02/2014 | Turn-key contracts signature for CHUI I and II implementation | GAMESA | EOL CH CH I 316 2014 EPC CHUI // EOL CH CH II 317 2014 EPC CHUI | After the IMPSA contract termination, a turn-key contract including GAMESA for the implementation was signed |
| 21/09/2013 | Turn-key contract signature for VERACE I-X implementation | SCHAHIN, PAVSOLO | SP 509 2013 EPC PAVSOLO | Implementation contract between the entrepreneurs and the companies SCHAHIN and PAVSOLO |
| 30/04/2014 | Complementary agreement for construction works acceleration VERACE I-X | GAMESA | Acordo Complementar aos EOL's 076 077 078 079 080 081 082 083 084 085 - GAMESA | A complimentary agreement only to alter contract dates and targets |
| 04/10/2014 | Amendment to complementary agreement for construction works acceleration VERACE I-X | GAMESA | A1AC ST EOL's 076, 077, 078, 079, 080, 081, 082, 083, 084 e 085 | Na amendment to the complimentary agreement for construction works was signed |
| 19/09/2015 | Turn-key contract termination (VERACE I-X) | GAMESA | TERMO DE ENCERRAMENTO CONT EPC GERIBATU | The turn-key contract for VERACE facilities was terminated. The contract termination is a legal tool to resolve disputes related to extraordinary costs. |
| 19/09/2015 | Turn-key contract termination (CHUI I,II,IV, V; MINUANO I and II) | GAMESA | TERMO DE ENCERRAMENTO CONT EPC CHUÍ | The turn-key contract for CHUI and MINUANO facilities was terminated. The contract termination is a legal tool to resolve disputes related to extraordinary costs. |

The first registered PDD (Version 03, dated 22 June 2012) considers the same Windfarm Complex configuration in force as that of the investment decision date (i.e. the date of the 12th Brazilian Auction of New Energy). IMPSA would be the aerogenerator supplier to Chuí´s and Minuano´s plants, whereas GAMESA would be the aerogenerator supplier to Verace's plants.

As presented in Table 3 – Timeline for implementation of registered project activity, on 24/09/2013 the entrepreneurs ceased the contract with IMPSA. The reasons for the contract caseation encompass the fact that this supplier would not be able to deliver the aerogenerators. At the time of project implementation, IMPSA was also responsible for supplying aerogenerators for several other wind power plants under construction in Brazil. Many were the cases of delivery default, thus causing a profound and negative impact in the Brazilian electricity sector. IMPSA soon went bankrupt leaving a default as high as 1580 MW wind power capacity in the country (reference: Caso Impsa_Energia Inteligente; Falencia IMPSA).

In light of these facts, the project developer was forced to change the aerogenerator supplier of Chuí and Minuano facilities after the project implementation had commenced. Gamesa was the new supplier of choice, since it was successfully delivering the aerogenerators for the other facilities of the project activity.

The equipment of the two suppliers have similar characteristics (2MW capacity) However, Chuí and Minuano facilities, equipped with the GAMESA aerogenerators, are expected to deliver a lower net capacity than that of the registered PDD (plant load factor weighted average of the windfarms was 46,2% and now is 44.4%, and the net capacity was 185.6 MW and now is 178.5 MW). Therefore, when compared to the previous configuration, the current project is expected to deliver a smaller amount of energy to the grid and, therefore, smaller-than-anticipated electricity revenues shall be observed. Moreover, this whole process was associated with not-anticipated costs and to delays in the start date of the electricity generation (and, therefore, cash inflow) (refer to Table 3 – Timeline for implementation of registered project activity). In conclusion, the changes in the project configuration do not adversely impact the additionality of the project activity.

The project started delivering energy to the National Interconnected System on February 2015.

| Facility | Operation start |
|---|---|
| Verace I | Feb/2015 |
| Verace II | Feb/2015 |
| Verace III | Feb/2015 |
| Verace IV | Feb/2015 |
| Verace VI | Feb/2015 |
| Verace VII | Feb/2015 |
| Verace VIII | Feb/2015 |
| Verace IX | Feb/2015 |
| Verace X | Feb/2015 |
| Chui I | May/2015 |
| Chui II | May/2015 |
| Chui IV | May/2015 |
| Chui V | Apr/2015 |
| Minuano I | Apr/2015 |
| Minuano II | Apr/2015 |

## B.2. Post-registration changes

### B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

Not applicable.

### B.2.2. Corrections

Not applicable.

### B.2.3. Changes to the start date of the crediting period

The crediting period of the PDD was altered from 01 Jan 14 – 31 Dec 20 (first version) to 01 Jan 2015 – 31 Dec 21, reflected on UNFCCC project view page.

### B.2.4. Inclusion of monitoring plan

Not applicable.

### B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

**The change refers to a Permanent Change from the registered Monitoring Plan.**

**Change in the meter used to calculate $EG_{PJ,y}$**

The registered version of the PDD indicates two pairs (a pair consists of a main and a backup meter) of meters as the ones that would monitor the electricity supplied to the grid. These meters are located at the Santa Vitória do Palmar Substation and would be the ones used to monitor the parameter $EG_{PJ,y}$. However, these meters measure the generated electricity prior to its transformation from 138 kV to 525 kV. Therefore, there is another meter pair that measures the generated electricity after the transformation to 525 kV, which is the tension in which the electricity is actually supplied to the grid. Moreover, the formerly described meter pair is the one used by the Electricity Commercialization Chamber (*Câmara de Comercialização de Energia Elétrica* - CEEE) to account / invoice electricity sales.

In light of the above explanation, the revised monitoring plan will use the meter pair (a.k.a. SPA TF3) that monitors the generated electricity after its transformation to 525 kV as the metering point used to monitor the parameter $EG_{PJ,y}$ and to calculate the emission reductions of the project activity.

The figure below (Figure 2) represents the meter's configuration described in the registered version of the PDD, followed by Figure 3, representing the actual system configuration, containing the meter pair that measures the generated electricity after the transformation to 525kV (SPA TF3).

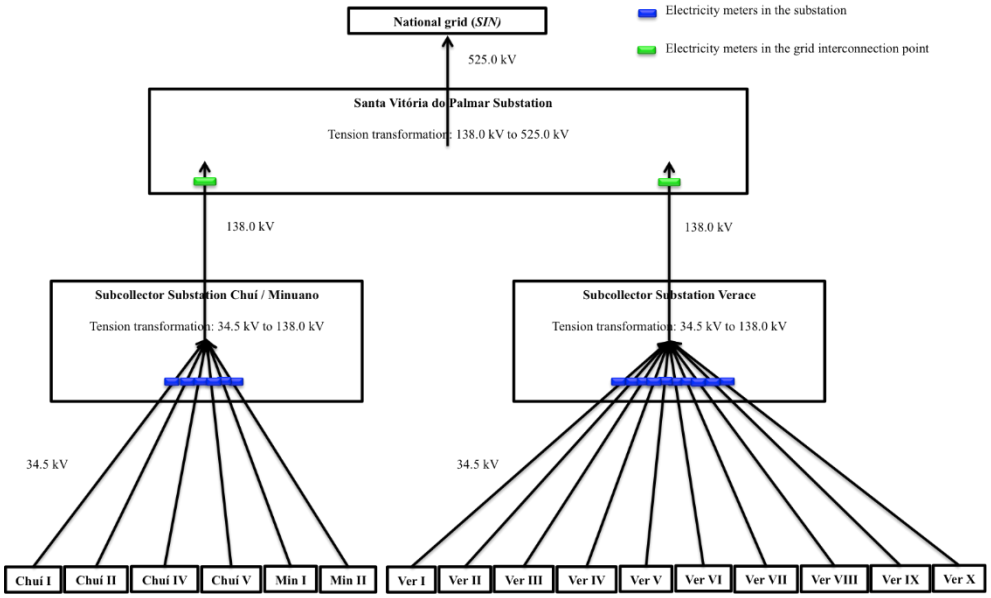


**Figure 2:** Simplified wiring diagram described in the registered version of the PDD.

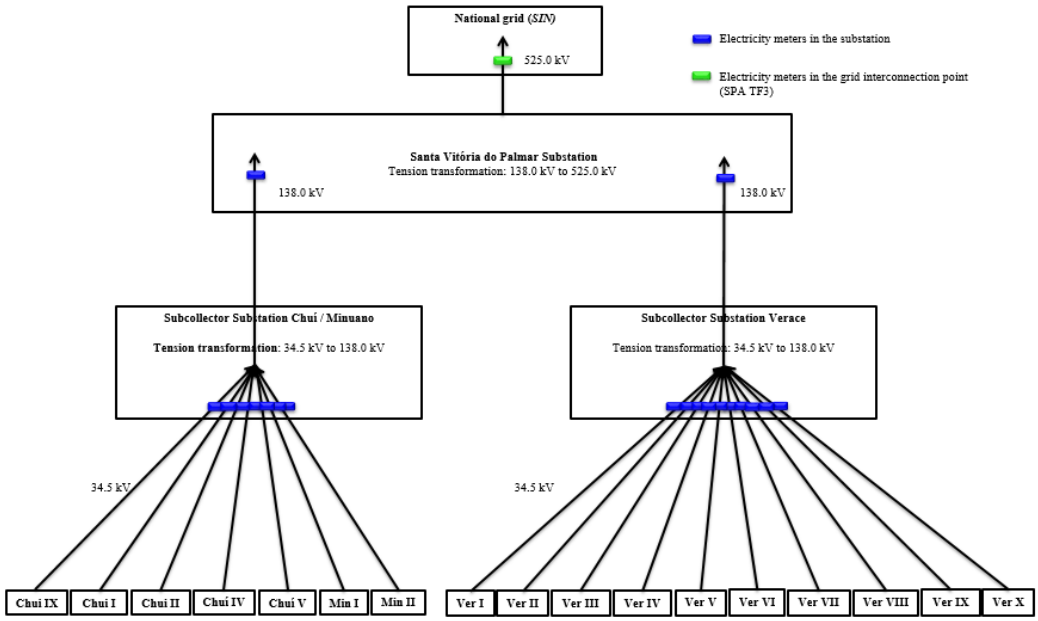


**Figure 3:** Simplified wiring diagram of actual system configuration, indicating the delivery point (SPA TF3).

## Pro-rating of $EG_{PJ,y}$

Another wind power facility, namely CHUI IX (not included in the project activity), was connected to the subcollector substation Chuí/Minuano, where the project activity's facilities CHUI I, CHUI II, CHUI IV, CHUI V, Minuano I and Minuano II are connected to. Consequently, the electricity generated by CHUI IX will sum up into the amount metered by SPA TF3.

In light of that, in the revised monitoring plan, $EG_{PJ,y}$ is monitored as the electricity monitored by SPA TF3 pro-rated by the electricity generated by the project plants (CHUI I, CHUI II, CHUI IV, CHUI V, Minuano I, Minuano II, Verace I, Verace II, Verace III, Verace IV, Verace V, Verace VI, Verace VII, Verace VIII, Verace IX, Verace X) and the electricity generated by CHUI IX.

The pro-rating formula is:

$$EG_{PJ,y} = \Sigma_h\{EG_{SPA\ TF3,h} * \Sigma_{project\_facility}(EG_{project\_facility,h}) / [\Sigma_{project\_facility}(EG_{project\_facility,h}) + EG_{Chui\ 9,h}]\}$$

Where:

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

$EG_{SPA\ TF3,h}$ = Hourly electricity generation measured by the meter SPA TF3 (MWh/hour);

$EG_{project\_facility,h}$ = Hourly electricity generation by the project plants (CHUI I, CHUI II, CHUI IV, CHUI V, Minuano I, Minuano II, Verace I, Verace II, Verace III, Verace IV, Verace V, Verace VI, Verace VII, Verace VIII, Verace IX, Verace X) measured by their respective individual meters located at subcollector substations Chui / Minuano or Verace (MWh/hour);

$EG_{Chui\ 9,h}$ = Hourly electricity generation by CHUI IX measured by its individual meters located at subcollector substations Chui / Minuano (MWh/hour).

As described in the registered PDD, and analogous procedure is adopted by CCEE in order to account / invoice the electricity sales by each individual facility.

### B.2.6. Changes to project design

As of August 9, 2012, the entrepreneurs signed the first turn-key contract including Gamesa and Schahin for the implementation of VERACE I-X. This date defines the Starting Date of the project activity.

The first registered PDD (Version 03, dated 22 June 2012) considers the same Windfarm Complex configuration in force as that of the investment decision date (i.e. the date of the 12th Brazilian Auction of New Energy). IMPSA would be the aerogenerator supplier to Chuí´s and Minuano´s plants, whereas GAMESA would be the aerogenerator supplier to Verace's plants.

As presented in Table 3 – Timeline for implementation of registered project activity, on 24/09/2013 the entrepreneurs ceased the contract with IMPSA. The reasons for the contract caseation encompass the fact that this supplier would not be able to deliver the aerogenerators. At the time of project implementation, IMPSA was also responsible for supplying aerogenerators for several other wind power plants under construction in Brazil. Many were the cases of delivery default, thus causing a profound and negative impact in the Brazilian electricity sector. IMPSA soon went bankrupt leaving a default as high as 1580 MW wind power capacity in the country (reference: Caso Impsa_Energia Inteligente; Falencia IMPSA)

In light of these facts, the project developer was forced to change the aerogenerator supplier of Chuí and Minuano facilities after the project implementation had commenced. Gamesa was the new supplier of choice, since it was successfully delivering the aerogenerators for the other facilities of the project activity.

The equipment of the two suppliers have similar characteristics (2MW capacity) However, CHUÍ and MINUANO facilities, equipped with the GAMESA aerogenerators, are expected to deliver a lower net capacity than that of the registered PDD (plant load factor weighted average of the windfarms was 46,2% and now is 44.4%, and the net capacity was 185.6 MW and now is 178.5 MW). Therefore, when compared to the previous configuration, the current project is expected to deliver a smaller amount of energy to the grid and, therefore, smaller-than-anticipated electricity revenues shall be observed. Moreover, this whole process was associated with not-anticipated costs and to delays in the start date of the electricity generation (and, therefore, cash inflow) (refer to Table 9 – Timeline for implementation of registered project activity). In conclusion, the changes in the project configuration do not adversely impact the additionality of the project activity.

## SECTION C. Description of monitoring system

>>

Description of the monitoring plan:

### 1. General Considerations

The objective of the monitoring plan is to ensure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions achieved by the project activity during the whole crediting period. The entrepreneurs (that are the project developer and operator) will be responsible for the implementation of the monitoring plan, which is based in monitoring the net electricity dispatched to the grid and the emission factor of the electricity grid.

### 2. Data and Parameters monitored

*Net electricity dispatched to the grid – $EG_{facility,y}$*

Monitoring consists of metering, compiling and archiving the data that refers to the net electricity generated by the project activity and delivered to the Brazilian national grid (SIN). The net electricity dispatched to the grid ( $EG_{facility,y} = EG_{PJ,y}$ ) will be monitored in the meters localized in the interconnection point with the Brazilian national grid (SIN); The electricity metered by these meters may also include energy generated by facilities outside the project boundary (currently, only CHUI IX, also referred as CHUI III, is connected, and not part of this project). The total amount dispatched to the SIN monitored by these meters will be prorated between each project facility according to the proportional amount of electricity generation measured in the electrical substation for each facility (Figure 5) Only the facilities within the project boundary will be considered for the ER calculations. This data will be crosschecked with the data provided by the Brazilian Electric Energy Commercialization Chamber (*CCEE – Câmara de Comercialização de Energia Elétrica*). This data is from a third party and reliable information, since CCEE is the official Brazilian agency responsible for the activities and operations of the national electricity market. Project operator will monitor this parameter continuously and data will be consolidated hourly and monthly. Monthly values will be used for crosschecking electricity dispatched in the interconnection point with the Brazilian national grid and the data provided by CCEE. Records pertaining to the meters used in the project activity (type, model and calibration reports) will be kept accordingly.

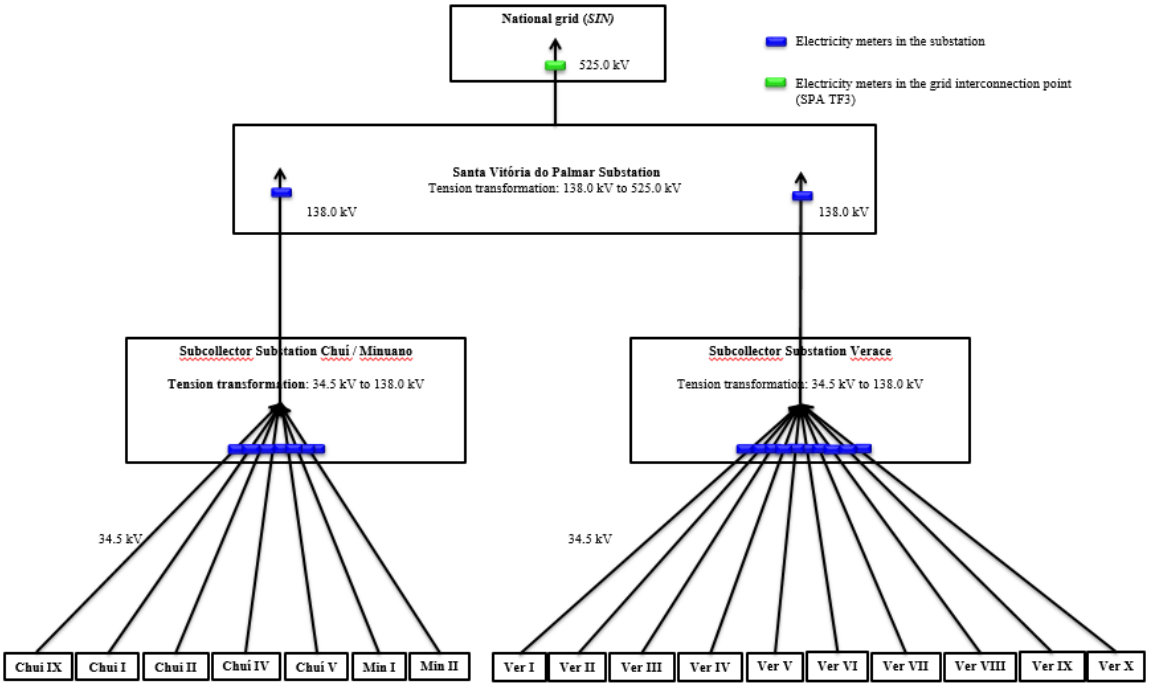


**Figure 5**: Simplified wiring diagram indicating the delivery point, location of the meters and tension transformation. Electricity meters in the interconnection point will be utilized in the emission reduction calculations; meters localized in the substation will be utilized for crosschecking.

The National Operator of the Electric System (*Operador Nacional do Sistema Elétrico - ONS*) regulates, by means of its Grid Procedures [5] (*Procedimentos de Rede*), *inter alia*, the measurements of electricity production for invoicing (12th module). For information related to this module, it is necessary to maintain the Measurement for Invoicing System (*Sistema de Medição para Faturamento – SMF*) according to the standard specified in the document Technical Specifications of Measurement for Invoicing (*Especificação Técnica das Medições para Faturamento*) to assure not only the control of energy accounting process by CCEE, but also the determination of demands by ONS.

SMF is a system composed of the main and backup measurers, by the potential and current transformers, the channels of communication between energy agent/project participant and CCEE, and the system for data collection and measurement for invoicing.

According to the ONS Grid Procedures – Submodule 12.1, the SMF should be installed in the connection of the plants with the energy grid to measure the net generation of these plants, which will be used for accounting and settlement of electricity in the CCEE.

Data stored on the meters is collected by the System of Energy Data Collection (*Sistema de Coleta de Dados de Energia – SCDE*) of CCEE, remotely and automatically through direct access to the meters of the project participant. These collected data are processed in SCDE for electricity accounting by CCEE and are available to all energy market participants to control their respective incomes.

The energy meters shall be: multi-phase, 3 elements, 4 wire (for 4 wire systems), of system rated frequency, rated current according to the secondary of current transformer, nominal voltage according to the secondary of potential transformer. The meters shall have independence of

[5] National Operator of the Electric System (*Operador Nacional do Sistema Elétrico* - ONS). Grid Procedures (*Procedimentos de Rede*). www.ons.org.br/procedimentos/index.aspx. Accessed in 14/07/2010.

elements and sequence of phases, ensuring the same performance in monophasic and three-phasic testing.

The measurement systems are designed and implemented in accordance with the standards of the Brazilian Association of Technical Standards (*Associação Brasileira de Normas Técnicas – ABNT*) or International Electrotechnical Commission - IEC, ensuring the quality of the system. In addition, the meters have certificate of conformity of design approved and issued by the National Institute of Metrology Standardization and Industrial Quality (*Instituto Nacional de Metrologia, Normalização e Qualidade Industrial – INMETRO*).

Regarding the class of accuracy of energy meters, they meet all relevant metrological requirements prescribed in Metrological Technical Regulation (*Regulamento Técnico Metrológico – RMT*) for Class 0.2 of energy meters, approved by INMETRO. Class 0.2 of energy meter, also identified as index D energy meters admits error in measurements of up to ±0.2%.

The energy meters possess mass memory capable of storing the data of active, reactive and demand energy in a bidirectional manner, voltages and currents at intervals of integration programmable from 5 to 60 minutes during the minimum period of 32 days. These meters will also be equipped with a system of preservation and salvage of records in case of power loss, storing data in non-volatile memory for at least 100 hours. In addition, they possess at least two independent communication ports with concurrent access or that allow the prioritization of one of them. One will be for the exclusive use of the CCEE and the other for access of agents involved in the measurement point. The CCEE communication port will be coupled to a stable and good performance internet channel, which will be established under a VPN tunnel (Virtual Private Network) between the meter and the CCEE. The meters will be able to manage concurrent access to its communications ports in order to allow full time access to mass memory records of meters via CCEE communication port.

Besides electricity measurements are performed by the project owners, all the electricity dispatched to the grid by the project activity will be monitored online by CCEE. This entity is responsible for the monthly readings and keeping the records of the energy generated. If any problem happens at the local meter level, the reading lecture corresponding to the amount of energy during the time of the problem will not be lost due to online reading performed by CCEE. As mentioned before, in order to assure the quality of data used in the emission reductions calculation, the project proponents will provide access to the DOE of the records of CCEE databank, because the data from this entity will serve to crosscheck the electricity dispatched to the grid.

Backup meters are equal or equivalent to the main meters, installed on the same panel, with the same information for current and voltage and under the same technical standards.

In order to ensure the effectiveness operation of SMF, preventive maintenance must be carried out and, where necessary, also corrective maintenance. Inspections are also conducted in order to verify the correct operation of meters.

The frequency for preventive maintenance of the SMF is a maximum of two years. This schedule may be changed based on the historical occurrence observed in all plants, considering the schedule of stops. The meter that after calibration displays errors outside the range specified by the standard must be replaced.

The calibration of meters shall be conducted by a qualified organization that must comply with national standards and industrial regulations to ensure the accuracy. After calibration, the meters must be sealed to assure the safety and the calibration certificates must be archived with the other monitoring records. The deadline for meter's calibration follows, therefore, the "Grid Procedures" from the ONS Module 12, Sub-module 12.3. By the time of completion of this document, the frequency of calibration is a maximum of two years, but in the case of any changes occurred in the

ONS Grid Procedures, the project owners shall follow the rules from the relevant sector organizations (e.g. ONS, ANEEL, CCEE, etc).

All the meters installed will be tested and calibrated in accordance with regulations provided by CCEE. Moreover, if any errors are detected in the measuring device, it will be immediately replaced by the backup meter, which will be previously calibrated. The damaged measuring device will be repaired, recalibrated and will return to the monitoring system.

In the case of any changes occurred in the ONS Grid Procedures and related documents, the project owners shall follow the rules from the relevant sector organizations (e.g. ONS, ANEEL, CCEE, etc) in the net electricity dispatched to the grid ($EG_{facility,y}$) monitoring. The monitoring procedure described above reflects what is demanded today by ONS. In case of changes of these requirements, the new procedures will supersede what is described here.

*Emission Factor – $EF_{grid,OM,y}$, $EF_{grid,BM,y}$ and $EF_{grid,CM,y}$*

The monitoring plan also includes parameters such as the operating margin $CO_2$ emission factor for power units in the top of the dispatch order ($EF_{grid,OM,y}$), the build margin $CO_2$ emission factor ($EF_{grid,BM,y}$) of SIN and the combined margin $CO_2$ emission factor ($EF_{grid,CM,y}$). These parameters will be obtained from the Brazilian Interministerial Commission for Climate Change (Brazilian DNA), which calculates and publishes $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ according to the most recent version of the "Tool to calculate the emission factor for an electricity system". These published parameters will be used for the calculation of the yearly combined margin ($EF_{grid,CM,y}$) and, ultimately, for the calculation of the emission reductions achieved by the project activity. In case the DNA ceases to publicize $EF_{grid,OM,y}$, $EF_{grid,BM,y}$ and/or $EF_{grid,CM,y}$, project proponents may choose to use its own or third-party calculated Emission Factors, which follow the "Tool to calculate the emission factor for an electricity system."

All data collected as part of monitoring will be archived and kept at least for 2 years after the end of the crediting period or 2 years after the last issuance of CER for this project activity, whichever occurs later.

## 3. Monitoring Structure

The operational and management structure that the project operator implemented in order to monitor emission reductions achieved by the project activity is as given in the flowchart in Figure 4.

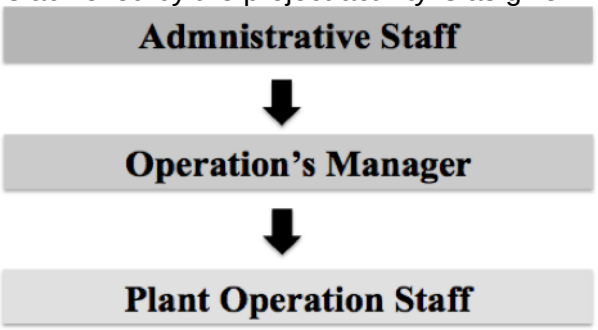


**Figure 4:** Operational and management structure that the project operator implemented in order to monitor emission reductions achieved by the project activity.

The roles and responsibilities within the structure outlined in Figure 4 are described in detail in the paragraphs below.

Administrative Staff: Responsible for go along with the auditor during the verification visit and provide all necessary documents related to the records of the net electricity supply to the grid. For the purpose of CDM verification, the Administrative Staff provided access to the records of CCEE databank in order to demonstrate that electricity generation data is consistent and accurate. The Administrative Staff forwards all electronic media-based information to the CDM Consultancy Company at a minimum bimonthly frequency.

Operation's Manager: Responsible for the record keeping and indexing of the data pertaining to the net electricity supply to the grid. Its attributions also include ensuring that the monitored data pertaining to the net electricity generation is continuously sent (online) to the Electric Energy Commercialization Chamber (*CCEE – Câmara de Comercialização de Energia Elétrica*).

Plant Operation Staff: Responsible for the general supervision of the plant operation and for the supervision of the metering. Its attributions also include ensuring that meters included in the present monitoring plan are calibrated and undergo maintenance as per the applicable regulations and manufactures' recommendations. Any meter calibration procedures will be reported to the Administrative Staff.

*Training procedures*

In order to ensure accuracy of the monitored data and to guarantee the quality of the monitoring plan, the the consultancy WayCarbon Soluções Ambientais e Projetos de Carbono Ltda provided a digital training course for the Administrative Staff on monitoring methodologies, procedures and archiving. Then, the material is used by the CDM Manager to train the project staff in respect to the CDM monitoring. The training course covers initial training on CDM, monitoring methodology, monitoring procedures and requirements and archiving.

### 4. Compilation of Monitoring Reports

As previously mentioned, monitored data is forwarded to the CDM Consultancy Company (WayCarbon Soluções Ambientais e Projetos de Carbono Ltda.) at a minimum bimonthly basis. Besides being responsible for collecting the information pertaining to the calculation of the grid emission factor ( $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ ), the CDM Consultancy Company compiles the monitoring reports and is responsible for the calculation of the emission reductions achieved by the project activity.

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante

| **Data/Parameter** | $w_{OM}$ |
|---|---|
| Unit | Fraction |
| Description | Weighting of operating margin emissions factor |
| Source of data | "Tool do calculate the emission factor for an electricity system", Version 02.2.1 |
| Value(s) applied | 75% |
| Choice of data or measurement methods and procedures | Default value for wind power plants. |

| | |
|---|---|
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | This value will be applied in the subsequent crediting periods. |

| **Data/Parameter** | $w_{BM}$ |
|---|---|
| Unit | Fraction |
| Description | Weighting of build margin emissions factor |
| Source of data | "Tool do calculate the emission factor for an electricity system", Version 02.2.1 |
| Value(s) applied | 25% |
| Choice of data or measurement methods and procedures | Default value for wind power plants. |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | This value will be applied in the subsequent crediting periods. |

## D.2. Data and parameters monitored

| **Data/Parameter** | $EG_{facility,y} = EG_{PJ,y}$ |
|---|---|
| Unit | MWh |
| Description | Quantity of net electricity generation supplied by the project plant to the grid in year y |
| Measured/calculated/ default | Measured and calculated |
| Source of data | Project activity site. |
| Value(s) of monitored parameter | 2015: 984,432 MWh<br>till 15th of April 2016: 325,079 MWh |

| Year | Month | EG project activity,month | EG project activity,year |
|---|---|---|---|
| 2015 | jan | 0 | 984.432 |
| | fev | 32.443,70 | |
| | mar | 46.751,50 | |
| | abr | 55.905,44 | |
| | mai | 66.702,53 | |
| | jun | 98.969,57 | |
| | jul | 84.046,82 | |
| | ago | 131.588,58 | |
| | set | 105.074,87 | |
| | out | 143.108,97 | |
| | nov | 116.176,05 | |
| | dez | 103.664,29 | |
| 2016 | jan | 103.104,11 | 325.079 |
| | fev | 76.991,57 | |
| | mar | 93.988,38 | |
| | abr (till 15th) | 50.994,83 | |

Monitoring equipment

Type: Electricity Meter ION 8650.

| Facility | Meter code | Meter serial# | Meter type | Last calib. Date | Calib. certify. # |
|---|---|---|---|---|---|
| Chui I | RSCHU-CH01-01P | MW1310A364-01 | Main | 29/09/2015 | 16/2015 |
| Chui I | RSCHU-CH01-01R | MW1309A508-01 | Backup | 01/10/2015 | 17/2015 |
| Chui II | RSCHU-CH02-02P | MW1310A504-01 | Main | 30/09/2015 | 18/2015 |
| Chui II | RSCHU-CH02-02R | MW1309A723-01 | Backup | 30/09/2015 | 19/2015 |
| Chui IV | RSCHU-CH04-03P | MW1308A359-01 | Main | 30/09/2015 | 22/2015 |
| Chui IV | RSCHU-CH04-03R | MW1309A281-01 | Backup | 02/10/2015 | 23/2015 |
| Chui V | RSCHU-CH05-04P | MW1309A564-01 | Main | 02/10/2015 | 24/2015 |
| Chui V | RSCHU-CH05-04R | MW1310A182-01 | Backup | 03/10/2015 | 25/2015 |
| Min. I | RSCHU-MN01-05P | MW1310A568-01 | Main | 02/10/2015 | 26/2015 |
| Min. I | RSCHU-MN01-05R | MW1309A056-01 | Backup | 04/10/2015 | 27/2015 |
| Min. II | RSCHU-MN02-06P | MW1310A344-01 | Main | 03/10/2015 | 28/2015 |
| Min. II | RSCHU-MN02-06R | MW1310A402-01 | Backup | 03/10/2015 | 29/2015 |
| SPA LT Chui | RSSPA2CECH-05P | MW1310A340-01 | Main | 05/10/2015 | 34/2015 |
| SPA LT Chui | RSSPA2CECH-05R | MW1310A508-01 | Backup | 07/10/2015 | 35/2015 |
| Verace I | RSCBGTEVRC101P | MW1310A191-01 | Main | 11/11/2015 | 40/2015 |
| Verace I | RSCBGTEVRC101 R | MW1310A184-01 | Backup | 12/11/2015 | 41/2015 |
| Verace II | RSCBGTEVRC202P | MW1310A572-01 | Main | 11/11/2015 | 42/2015 |
| Verace II | RSCBGTEVRC202 R | MW1309A372-01 | Backup | 12/11/2015 | 43/2015 |
| Verace III | RSCBGTEVRC303P | MW1310A398-01 | Main | 11/11/2015 | 44/2015 |
| Verace III | RSCBGTEVRC303 R | MW1310A526-01 | Backup | 12/11/2015 | 45/2015 |
| Verace IV | RSCBGTEVRC404P | MW1310A401-01 | Main | 12/11/2015 | 46/2015 |
| Verace IV | RSCBGTEVRC404 R | MW1309A552-01 | Backup | 13/11/2015 | 47/2015 |
| Verace v | RSCBGTEVRC505P | MW1309A457-01 | Main | 13/11/2015 | 48/2015 |
| Verace V | RSCBGTEVRC505 R | MW1309A332-01 | Backup | 14/11/2015 | 49/2015 |
| Verace VI | RSCBGTEVRC606P | MW1310A390-01 | Main | 13/11/2015 | 50/2015 |
| Verace VI | RSCBGTEVRC606 R | MW1310A181-01 | Backup | 15/11/2015 | 51/2015 |
| Verace VII | RSCBGTEVRC707P | MW1309A418-01 | Main | 14/11/2015 | 52/2015 |
| Verace VII | RSCBGTEVRC707 R | MW1309A290-01 | Backup | 15/11/2015 | 53/2015 |
| Verace VIII | RSCBGTEVRC808P | MW1309A327-01 | Main | 14/11/2015 | 54/2015 |
| Verace VIII | RSCBGTEVRC808 R | MW1309A422-01 | Backup | 15/11/2015 | 55/2015 |
| Verace IX | RSCBGTEVRC909P | MW1310A026-01 | Main | 16/11/2015 | 56/2015 |
| Verace IX | RSCBGTEVRC909 R | MW1310A174-01 | Backup | 17/11/2015 | 57/2015 |
| Verace X | RSCBGTEVR1010P | MW1310A396-01 | Main | 16/11/2015 | 58/2015 |
| Verace X | RSCBGTEVR1010R | MW1310A333-01 | Backup | 18/11/2015 | 59/2015 |
| SPA LT Ger | RSSPA2CEGBT03P | MW1309A452-01 | Main | 05/10/2015 | 32/2015 |
| SPA LT Ger | RSSPA2CEGBT03R | MW1310A186-01 | Backup | 05/10/2015 | 33/2015 |
| SPA TF3 525 kV | RSSPA2EGBCM04 P | MW1309A114-01 | Main | 05/10/2015 | 30/2015 |
| SPA TF3 525 kV | RSSPA2EGBCM04 R | MW1309A444-01 | Backup | 06/10/2015 | 31/2015 |

| | |
|---|---|
| Measuring/reading/recording frequency | Data is monitored continuously with hourly recording. Data will be archived electronically until two years after finishing the crediting period. |
| Calculation method (if applicable) | This parameter will be continuously analyzed and monitored. Values will be aggregated monthly and yearly. Corresponds to the total net electricity generation by the 16 facilities of the project activity. This parameter will be monitored in meters localized in the interconnection point with the Brazilian national grid (SIN); the total amount dispatched to the SIN monitored by these meters will be prorated between each project facility according to the proportional amount of electricity generation measured in the electrical substation for each facility (Figure 5).<br>$EG_{PJ,y}$ is calculated as the electricity metered by SPA TF3, pro-rated by the electricity generated by the project plants (CHUI I, CHUI II, CHUI IV, CHUI V, Minuano I, Minuano II, Verace I, Verace II, Verace III, Verace IV, Verace V, Verace VI, Verace VII, Verace VIII, Verace IX, Verace X) and the electricity generated by CHUI IX.<br>The pro-rating formula is:<br>$EG_{PJ,y} = \Sigma_h\{EG_{SPA\ TF3,h} * \Sigma_{project\_facility}(EG_{project\_facility,h}) / [\Sigma_{project\_facility}(EG_{project\_facility,h}) + EG_{Chui\ 9,h}]\}$<br>Where:<br>$EG_{PJ,y}$ = Quantity of net electricity generation that is producded and fed into the grid as a result of the CDM project activity (MWh/yr);<br>$EG_{SPA\ TF3,h}$ = Hourly electricity generation measured by the meter SPA TF3 (MWh/hour);<br>$EG_{project\_facility,h}$ = Hourly electricity generation by the project plants (CHUI I, CHUI II, CHUI IV, CHUI V, Minuano I, Minuano II, Verace I, Verace II, Verace III, Verace IV, Verace V, Verace VI, Verace VII, Verace VIII, Verace IX, Verace X) measured by their respective individual meters located at subcollector substations Chui / Minuano or Verace (MWh/hour);<br>$EG_{Chui\ 9,h}$ = Hourly electricity generation by CHUI IX measured by its individual meters located at subcollector substations Chui / Minuano (MWh/hour). |
| QA/QC procedures | The monthly amount of electricity generated by each project plant, metered at the subcollector substation, is crosschecked with the amount of electricity accounted / invoiced by the Brazilian Electric Energy Commercialization Chamber (*CCEE – Câmara de Comercialização de Energia Elétrica*). This data is a third party and reliable information, since CCEE is the official Brazilian agency responsible for the activities and operations of the national electricity market. |
| Purpose of data/parameter | Calculation of baseline emissions |
| Additional comments | "SPA LT Ger" and "SPA LT Chui" monitor the electricity generation of all facility of Verace, Chui/Minuano, respectively. The results of these meters are used for cross-check only. They are not used for the calculation of emission reductions. |

| **Data/parameter:** | $EF_{grid, CM, y}$ |
|---|---|
| Unit | $tCO_2/MWh$ |
| Description | Combined margin $CO_2$ emission factor in year y |
| Measured/calculated/default | Calculated |
| Source of data | Ministry of Science and Technology of Brazil |
| Value(s) of monitored parameter | 2015: 0.4787 $tCO_2/MWh$<br>till 15th of April 2016: 0.4971 $tCO_2/MWh$ |

| | |
|---|---|
| Monitoring equipment | No monitoring equipment is involved |
| Measuring/reading/recording frequency: | Annually |
| Calculation method (if applicable): | Calculation consists of weighed average of the yearly emission factor of the operating margin (OM) and the build margin (BM). Weighting factors are those provided in section D1 ($w_{OM}$ and $w_{BM}$). |
| QA/QC procedures: | As per the most recent version of the "Tool to calculate the emission factor for an electricity system". |
| Purpose of data: | Calculation of baseline emissions |
| Additional comments: | - |

| **Data/parameter:** | $EF_{grid, OM, y}$ |
|---|---|
| Unit | $tCO_2/MWh$ |
| Description | Operating margin $CO_2$ emission factor in year y |
| Measured/calculated/default | Calculated |
| Source of data | Brazilian Interministerial Commission on Global Climate Change |
| Value(s) of monitored parameter | 2015: 0.5531 $tCO_2/MWh$<br>till 15th of April 2016: 0.6101 $tCO_2/MWh$ |
| Monitoring equipment | No monitoring equipment is involved |
| Measuring/reading/recording frequency: | Hourly emission factors of the operating margin are averaged annually, weighted by the hourly amount of electricity fed into the grid by the project activity. |
| Calculation method (if applicable): | As per the most recent version of the "Tool to calculate the emission factor for an electricity system". This parameter is calculated as per the dispatch data analysis method. This means that the emission factor of the operating margin is calculated hourly and averaged yearly, weighted by the hourly amount of electricity fed into the grid by the project activity. |
| QA/QC procedures: | As per the most recent version of the "Tool to calculate the emission factor for an electricity system". |
| Purpose of data: | Calculation of $EF_{grid, CM, y}$. |
| Additional comments: | - |

| **Data/parameter:** | $EF_{grid, BM, y}$ |
|---|---|
| Unit | $tCO_2/MWh$ |
| Description | Build margin $CO_2$ emission factor in year y |
| Measured/calculated/default | Calculated |
| Source of data | Ministry of Science and Technology of Brazil |
| Value(s) of monitored parameter | 2015: 0.2553 $tCO_2/MWh$<br>2016: 0.1581 $tCO_2/MWh$ |
| Monitoring equipment | No monitoring equipment is involved |
| Measuring/reading/recording frequency: | Annually |
| Calculation method (if applicable): | As per the most recent version of the "Tool to calculate the emission factor for an electricity system". |
| QA/QC procedures: | As per the most recent version of the "Tool to calculate the emission factor for an electricity system". |
| Purpose of data: | Calculation of $EF_{grid, CM, y}$. |
| Additional comments: | By the time of completion of the monitoring report, the 2016 value was not yet available in the website of the Brazilian Ministry of Science and Technology. |

### D.3. Implementation of sampling plan

>>
Not applicable.

## SECTION E. Calculation of emission reductions or net anthropogenic removals

### E.1. Calculation of baseline emissions or baseline net removals

>>
Baseline emissions were calculated as follows:

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

Where:

$BE_y$: Baseline emissions in year 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 year y (MWh/yr);

$EF_{grid,CM,y}$: Combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2$/MWh).

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

The project plants serve Brazilian Interconnected System (SIN). The Brazilian DNA has published the delineation of SIN to be adopted for the purposes of CDM projects. As per Resolution nº 8 of the Brazilian DNA, the electric grid considered in this project activity is considered as a single system consisted by the sub-markets of SIN as the definition of the electric system of the project. Off-grid plants will not be included in the calculation of $EF_{grid,CM,y}$ .

$EF_{grid,CM,y}$ is calculated using the latest version of the "Tool to calculate the emission factor for an electricity system". The following formulae apply:

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

Where:

$EF_{grid,CM,y}$ = Combined 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);

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

$w_{OM}$ = Weighting of operating margin emissions factor (75%);

$w_{BM}$ = Weighting of build margin emissions factor (25%).

$EF_{grid,OM,y}$ was calculated as per the **Dispatch Data Analysis OM** calculated as per the most recent version of the "Tool to calculate the emission factor for an electricity system", according to the following formula:

$EF_{grid,OM\text{-}DD,y} = ( \Sigma_h EG_{PJ,h} * FE_{EL,DD,h} ) / EG_{PJ,y}$

Where

$EF_{grid,OM\text{-}DD,y}$ = Dispatch data analysis operating margin $CO_2$ emission factor in year y (t $CO_2$/MWh)

$EG_{PJ,h}$ = Electricity displaced by the project activity in hour h of year y (MWh)

$FE_{EL,DD,h}$ = $CO_2$ emission factor for grid power units in the top of the dispatch order in hour h in year y ($tCO_2$/MWh)

$EG_{PJ,y}$ = Total electricity displaced by the project activity in year y (MWh)

h = Hours in year y in which the project activity is displacing grid electricity

y = Year in which the project activity is displacing grid electricity

The parameters $FE_{EL,DD,h}$ and $EF_{grid,BM,y}$ are calculated and published by the Brazilian Ministry of Science and Technology, according to the most recent version of the "Tool to calculate the emission factor for an electricity system".

### E.2. Calculation of project emissions or actual net removals

>>

As per ACM0002/Version 12.2.0, since the project activity is neither a geothermal, solar nor a hydropower plant, $PE_y = 0$.

### E.3. Calculation of leakage emissions

>>

According to ACM0002, version 12.2.0, "no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emissions sources are neglected.".

### E.4. Calculation of emission reductions or net anthropogenic removals

| | Baseline GHG emissions or baseline net GHG removals (t $CO_2$e) | Project GHG emissions or actual net GHG removals (t $CO_2$e) | Leakage GHG emissions (t $CO_2$e) | GHG emission reductions or net anthropogenic GHG removals (t $CO_2$e) | | |
|---|---|---|---|---|---|---|
| | | | | Before 01/01/2013 | From 01/01/2013 | Total amount |
| **Total** | 632,797 | 0 | 0 | 0 | 632,797 | 632,797 |

### E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

| Amount achieved during this monitoring period (t $CO_2$e) | Amount estimated ex ante (t $CO_2$e) |
|---|---|
| 795,064 | 632,797 |

## E.6. Remarks on increase in achieved emission reductions

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The value of the emission reductions (632,797 tCO2) achieved during the monitoring period (01st Jan/2015 to 15th Apr/2016) was 23.5% lower that the value estimated in the ex ante calculation of the registered PDD.

Such difference may be explained by the fact that, the present project claims zero credits for the period of 01 January 2015 to 01 February 2015, as the wind complex started operation on 01 February and the facilities CHUI I, CHUI II, CHUI IV, CHUI V, MINUANO I and MINUANO II only began operating between April/2015 and May/2015.

Contrastingly, in the registered PDD, for the purpose of ex-ante estimations of emission reduction, the average value of the emission factor of the combined margin in the three previous years was used (0.3941 tCO2/MWh). However, the ex-post monitored values of this parameter were 21% and 26% higher, respectively, for the years 2015 and 2016. Such increase was caused by the higher participation of the fossil fuel-fired resources in the Brazilian electric matrix.

## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 06.0 | 7 June 2017 | Revision to:<br>• Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN);<br>• Make editorial improvements. |
| 05.1 | 4 May 2015 | Editorial revision to correct version numbering. |
| 05.0 | 1 April 2015 | Revisions to:<br>• Include provisions related to delayed submission of a monitoring plan;<br>• Provisions related to the Host Party;<br>• Remove reference to programme of activities;<br>• Overall editorial improvement. |
| 04.0 | 25 June 2014 | Revisions to:<br>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));<br>• Include provisions related to standardized baselines;<br>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;<br>• Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*;<br>• Editorial improvement. |
| 03.2 | 5 November 2013 | Editorial revision to correct table in page 1. |
| 03.1 | 2 January 2013 | Editorial revision to correct table in section E.5. |
| 03.0 | 3 December 2012 | Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11). |
| 02.0 | 13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20). |
| 01.0 | 28 May 2010 | EB 54, Annex 34. Initial adoption. |

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