VTRM RENEWABLE ENERGY 2

Document Prepared by Ecopart Assessoria em Negócios Empresariais Ltda.

Project Title	VTRM Renewable Energy 2
Version	2.0
Report ID	*Identification number of this document*
Date of Issue	*18-January-2021*
Project ID	*1903*
Monitoring Period	01-March-2019 to 30-September-2020
Prepared By	Ecopart Assessoria em Negócios Empresariais Ltda.
Contact	Alexsandro Antonio Cota alexsandro.cota@venergia.com.br +55 (11) 2874-2775 8501, Dra. Ruth Cardoso Av., 2nd Floor, São Paulo/SP, Brazil

CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

VTRM Renewable Project 2 (hereinafter referred as VTRM Renewable Energy 2) is a grouped project that consists on the implantation and operation of wind power plants (WPPs) in Brazil. All included WPPs supply clean electricity to the Brazilian National Interconnected System (SIN from the Portuguese *Sistema Interligado Nacional*).

VTRM Renewable Energy reduce greenhouse gases (GHG) emissions, avoiding electricity generation through fossil fuels sources. Clean and renewable electricity supply promotes an important contribution to environmental sustainability by reducing the GHG emissions that would occur in the absence of this project.

The baseline scenario is the same scenario existing before the implementation start of the project activity, which is: “the 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 calculations according to “Tool to calculate the emission factor for an electric system””.

The single and unique project activity instance included in VTRM Renewable Energy 2 grouped project is a complex called Ventos do Piauí Complex, composed by seven wind power plants. Power plants, installed capacity, quantity of wind turbine generators (WTG), location and operation startup are presented in Table 1.

This Monitoring Report refers to the second verification of VTRM Renewable Energy 2 which covers the period from 01/03/2019 to 30/09/2020. Total GHG emission reductions generated in this monitoring period is 522,964 tCO_2e.

Table 1 – Project Activity Instance: Ventos do Piauí Complex

Wind Power Plant	Installed Capacity (MW)	Nr. WTGs	Operation Startup	Location[1]
Ventos do Piauí Complex	**205.8**	**98**	**02/08/2017**	Curral Novo do Piauí - PI
Ventos de São Vicente 08	29.4	14	06/10/2017	Curral Novo do Piauí - PI
Ventos de São Vicente 09	29.4	14	06/12/2017	Curral Novo do Piauí - PI
Ventos de São Vicente 10	29.4	14	17/11/2017	Curral Novo do Piauí - PI
Ventos de São Vicente 11	29.4	14	09/11/2017	Curral Novo do Piauí - PI
Ventos de São Vicente 12	29.4	14	29/08/2017	Curral Novo do Piauí - PI
Ventos de São Vicente 13	29.4	14	19/09/2017	Curral Novo do Piauí - PI
Ventos de São Vicente 14	29.4	14	02/08/2017	Curral Novo do Piauí - PI

[1] Operation startup is according to authorizations issued through ANEEL Ordinances. Available at: <https://biblioteca.aneel.gov.br/index.html>

1.2 Sectoral Scope and Project Type

Scope 1 – Energy (Renewable/Non-Renewable).

VTRM Renewable Energy 2 is a grouped project.

1.3 Project Proponent

Organization name	VTRM ENERGIA PARTIPAÇÕES S.A.
Contact person	Alexsandro Antonio Cota
Title	Sustainable Manager
Address	8501, Dra. Ruth Cardoso Av., 2nd Floor, São Paulo/SP, Brazil
Telephone	+55 (11) 2874-2775
Email	alexsandro.cota@venergia.com.br

1.4 Other Entities Involved in the Project

Organization name	Ecopart Assessoria em Negócios Empresariais Ltda.
Role in the Project	Advisory company for the project development under the VCS
Contact person	A. Ricardo J. Esparta
Title	Technical director
Address	R. Padre João Manuel, 222, 01411-000, São Paulo, SP, Brazil
Telephone	+55 (11) 3063-9068
Email	ricardo.esparta@eqao.com.br

1.5 Project Start Date

02-August-2017

According to the VCS Standard v4.0, the project starting date is the date on which the project began generating GHG emission reductions or removals.

Therefore, the project start date of VTRM Renewable Energy 2 is 02-August-2017, *i.e.* the operation startup of the first WTG of the Complex Ventos do Piauí as can be checked in ANEEL Ordinance nr. 2,328 issued on 01-August-2017.

1.6 Project Crediting Period

02-August-2017 – 01-August-2027

Duration: 10 years, 0 months

According to the VCS Standard v4.0, the project crediting period shall be a maximum of ten years which may be renewed at most twice.

1.7 Project Location

Wind power plants of Ventos do Piauí Complex are located in Curral Novo do Piauí, state of Piauí, northeastern region of Brazil. Coordinates of each plant are presented as follows according to the Brazilian Power Regulatory Agency (ANEEL/SIGEL):

Table 2 – Geographical Coordinates of Ventos do Piauí Power Plants[2]

Wind Power Plant	Geographical Coordinates	
	Latitude	Longitude
Ventos de São Vicente 08	320175	9114007
Ventos de São Vicente 09	317215	9113418
Ventos de São Vicente 10	319490	9114621
Ventos de São Vicente 11	319809	9115824
Ventos de São Vicente 12	321711	9112988
Ventos de São Vicente 13	322396	9115011
Ventos de São Vicente 14	325482	9116524

1.8 Title and Reference of Methodology

The project applies the CDM methodology ACM0002: “Grid-connected electricity generation from renewable sources” (version 19.0). ACM0002 also refers to the following tools:

(a) TOOL01: Methodological Tool “Tool for the demonstration and assessment of additionality”, version 07.0.0;

(b) TOOL07: Methodological Tool “Tool to calculate the emission factor for an electricity system”, version 07.0;

(c) TOOL24: Methodological Tool “Common Practice”, version 03.1;

(d) TOOL27: Methodological Tool “Investment Analysis”, version 08.0.

[2] Location of the first WTG: datum SIRGAS 2000, UTM 24 S (MER -39). Available at: https://sigel.aneel.gov.br/Down/

1.9 Participation under other GHG Programs

Not applicable. The project was not registered and is not seeking registration under any other GHG programs.

1.10 Other Forms of Credit

Not applicable. The project has not sought of received any other form of GHG-related environmental credit, including renewable energy certificate.

1.11 Sustainable Development

VTRM Renewable Energy 2 contributes to the sustainable development once contributing to the economic growth without compromising the future generations, respecting the concept of Sustainable Development, established by Brundtland Report, elaborated by the World Commission on Environment and Development. This report defines the term “sustainable development” as “the development that satisfies the present necessities, without compromising the capacity of future generations of supplying their own necessities”.

Therefore, VTRM Renewable Energy 2 contributes to sustainable development of its region and country since:

- It reduces greenhouse gas emissions (CO_2) from the Brazilian Interconnected System;
- It generates extra income for the landowners, while they can continue using the area for other activities, thus it increases and diversifies the lands productivity;
- Besides generating income for the landowners, it stimulates the regional economy by increasing tax revenues for the local government and direct and indirect job opportunities for local workers and service suppliers. The resulting economic stimulus improves capital stock in the region, which can allow investment in the infrastructure, productive capacity and consequently the satisfaction of the population’s basic needs. Thus, it can promote a virtuous cycle in the local economy;
- The described economic stimulus goes along with a general improvement of the local infrastructure such as road, electricity transmission system and stimulus for education;
- It uses equipment which have a domestic content and therefore induce the development of national technology and improvement of domestic know-how. By promoting the establishment and growth of the necessary industry equipment and services, the project contributes for availability wind generation technology increase, which, consequently, reduces maintenance costs and risks of the technology in the country;

- The project operation requires services from skilled operators and maintenance staff and therefore stimulates the development of a proficient tertiary sector in the region, thus creating opportunities for education, professionalization and employment;
- It is an important complement and diversification to the run-of-river hydroelectric generation. As Brazil's hydro and wind regimes are largely complementary, their combination allows to partially compensate the lack of hydropower storage capacity with minimal installation of thermal power generation units, while still providing enough energy security based on a portfolio of these complementary renewable sources.

2 SAFEGUARDS

2.1 No Net Harm

The environmental licensing comprises the environmental impact assessment, which is a legal requirement in Brazil. Before construction phases, some impacts were identified at the Environmental Impact Assessment (EIA) and monitoring programs were designed to mitigate these impacts. The Environmental Basic Program gives detail of actions taken to mitigate socio-economic impacts.

At this section, project proponent presents just the negative environmental and social impacts identified at the Environmental Impact Assessment and actions planned to mitigate them. It is worthwhile to highlight that main impacts of the project were identified as positive impacts but are not mentioned in this section.

The negative impacts for all plants are presented below. All of them were classified as low or medium impacts. None was classified as high impact.

- Change in the air quality caused by vehicle circulation, earth moving and operation of the machines;
- Noise generation related to civil works, earthworks, suppression of vegetation and other processes, during both implementation and operation phases, changing local acoustic conditions;
- Alteration of the surface layer of the soil caused by the removal of vegetation, with direct soil exposure to sunlight and rain, and the rotation of the material with earthmoving and excavation services;
- Geomorphological change with the regularization of the area;
- Intensification of erosive processes by soil waterproofing and increased of surface runoff;

- Alteration in the recharge of the aquifer by the increase of the surface runoff caused by the suppression of the vegetation;
- Change in surface water flow due to decreased drainage flow;
- Pressure on water resources;
- Vegetation suppression will directly result in damage to the vegetation cover and the reduction of local biodiversity;
- The deforestation action will result in alteration of the landscape by loss of biotic potential;
- Temporary disturbance of fauna caused by noise emission;
- Intervention in permanent preservation areas;
- Risks with accidents with birds and bats during operational phase;
- Tension over population related to job creation;
- Increased risk of accidents due to higher vehicle traffic in the region;Higher heavy equipment circulation might lead to the degradation of roadways, especially during
- the rainy season, which can increase the risk of accidents;
- Risk of incidents with people during construction activities;
- Impacts on archeological heritage caused by earth moving;
- Decrease of jobs after construction phase;
- Impacts on the original landscape.

To mitigate these impacts, several actions were planned in the Environmental Basic Project (PBA). The main actions are presented as follows:

- Environmental Plan for Construction;
- Noise Monitoring Program;
- Control and Deforestation Program;
- Degraded Areas Recovery Program;
- Program for the Protection of Permanent Preservation Areas;
- Rational Deforestation Program;
- Wildlife Monitoring Program;
- Environmental Education Program;
- Wildlife Protection and Management Program;
- Social Communication Program;

- Civil Works Signaling Program;
- Worker Protection and Workplace Safety Program;
- Archaeological Heritage Management Plan;
- Program for Paleontological Identification, Monitoring and Rescue;
- Environmental Program for Construction;
- Program for Technical Training and Use of Manpower.

2.2 Local Stakeholder Consultation

The public audience is one of the phases of the environmental impact assessment and one of the main channels of community participation at a local level before project construction. This procedure consists on presenting to the interested parties the environmental assessment report, clarifying doubts and collecting criticisms and suggestions on the entrepreneurship and the areas to be affected. The place where public audiences happen must be easily accessed by the interested parties.

During the licensing process of the wind plants comprised in the new instance, Environmental Impact Assessments of the projects were submitted to public audience. The public audience notice was published in a regional large circulation newspaper, radios and banners. Date, hour and place of the event were presented in advance.

Public audiences for the seven WPPs were held in the 3 cities identified as directly or indirectly affected by the project activity:

- Curral Novo do Piauí/PI: January 19th, 2016;
- Betânia do Piauí/PI: January 20th, 2016;
- Paulistana/PI: January 21th, 2016.

Questions raised during public audience were answered by entrepreneur team and they are dully registered by the environmental entity responsible for the licensing process (SEMAR - Secretary of Environment and Water Resources of Piauí State). These questions did not any cause any change in the project.

There are mechanisms for on-going communication with local stakeholders. Through several channels, entrepreneurs communicate to stakeholders. The Social Communication Plan establishes a space of relationship between the community and the social actors involved with the enterprise and the entrepreneur, in order to allow a dialogue and the resolution of possible conflicts.

During VTRM Renewable Energy 2 validation, the project was published for public comments following VCS requirements and it did not receive any comment.

2.3 AFOLU-Specific Safeguards

Not applicable. VTRM Renewable Energy 2 is not an AFOLU project type.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The single and unique project activity instance included in VTRM Renewable Energy 2 grouped project is Ventos do Piauí Complex. The complex is operational since 02-August-2017.

Table below presents the main technical characteristics of power plants according to the Brazilian Power Regulatory Agency (ANEEL form the Portuguese *Agência Nacional de Energia Elétrica*). The average lifetime of the equipment is 20 years[3].

Table 3 – Technical Description of Ventos do Piauí Power Plants

Wind Power Plant	Installed Capacity (MW)	Assured Energy (MW-ave)	Plant Load Factor (%)
Ventos de São Vicente 08	29.4	15.20	51.7%
Ventos de São Vicente 09	29.4	15.20	51.7%
Ventos de São Vicente 10	29.4	15.20	51.7%
Ventos de São Vicente 11	29.4	15.00	51.0%
Ventos de São Vicente 12	29.4	15.00	51.0%
Ventos de São Vicente 13	29.4	15.40	52.4%
Ventos de São Vicente 14	29.4	15.30	52.0%

During the monitoring period, there were no events that may impact the GHG emission reductions or removals and monitoring.

[3] ANEEL (2009). Manual de Controle Patrimonial do Setor Elétrico. Annex of Normative Resolution nr. 367/2009, June 2nd, 2009. Available at: http://www.aneel.gov.br/cedoc/aren2009367_2_primeira_Ver.pdf. Last access on December 15th, 2020.

3.2 Deviations

2.3.1 Methodology Deviations

Not applicable. No methodology deviations are applied to the project during the monitoring period.

2.3.2 Project Description Deviations

Not applicable. No deviations are applied to the project during the monitoring period.

3.3 Grouped Projects

According to VCS Standard v4.0, grid-connected wind power plants are excluded from VCS since January 2020 and registered grouped projects are prohibited from adding new project activity instances of this project type.

Therefore, no new instance is included in this Monitoring Report.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	The percentage share of total installed capacity of the specific technology
Data unit	%
Description	The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country
Source of data	ANEEL
Value applied	8.8%
Justification of choice of data or description of measurement methods and procedures applied	Data provided by ANEEL[4]
Purpose of Data	Calculation of baseline emissions
Comments	-

[4] ANEEL Management Information Report, December/2018. Available at: http://www.aneel.gov.br/documents/656877/14854008/Boletim+de+Informa%C3%A7%C3%B5es+Gerenciais+-+4%C2%BA+trimestre+de+2018/36e91555-141a-637d-97b1-9f6946cc61b3. Acessed on May/2019.

Data / Parameter	The total installed capacity of the technology
Data unit	MW
Description	The total installed capacity of the technology in the host country
Source of data	ANEEL
Value applied	14,390,293
Justification of choice of data or description of measurement methods and procedures applied	Data provided by ANEEL[4]
Purpose of Data	Calculation of baseline emissions
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{facility,y}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)
Source of data	Meters at substation Curral Novo do Piauí 2 (CNP2)
Description of measurement methods and procedures to be applied	Electricity Meters
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value monitored	

Year	$EG_{facility,y}$
01 Mar 2019 - 31 Dec 2019	748,880
01 Jan 2020 - 30 Sep 2020	626,256
TOTAL	**1,375,136**

Monitoring equipment

At the substation CNP2, there are two meters (two principal and two rear) that register net electricity supplied to the grid by the project.

Data	Principal Meter 01	Rear Meter 01
Serial Number	MW – 1608A545-02	MW – 1608A683-02
Type	ION 8650	ION 8650

	Class	D	D
	Accuracy	0.20%	0.20%
	Supplier	Schneider Electric	Schneider Electric
	Last calibration	21/06/2016	23/09/2016
	Error identified	0.06%	0.11%
	Class, precision and calibration procedures of the meters follow ONS and National Authorities Guidelines and Procedures.		
QA/QC procedures to be applied	The uncertainty level for these data is low. The electricity supplied to the grid is monitored by the project participants directly from the meters. Project proponents have an outsourced agent hired that support measurement data collection. Commercial team cross-checks monthly data collected from the meters managed by COG (available at a web platform) and data provided by CCEE's Website (Electric Power Commercialization Chamber). Meters are calibrated in 5-year frequency according current to Grid Procedures from the National Operator of the Electric System (ONS).		
Purpose of the data	Calculation of baseline emissions		
Calculation method	Two specific meters are located in the Substation CNP2 that registers net electricity generated by all plants to the Grid. No calculation is necessary		
Comments	CCEE - Entity responsible for measurements, accounting and settlement on Brazilian electric energy market.		

Data / Parameter	$EF_{Grid,CM,y}$
Data unit	tCO_2e/MWh
Description	Combined margin emission factor for the grid in year y
Source of data	The combined margin emission factor was determined by using procedures established in "Tool to calculate the emission factor for an electricity system", version 07.0. Data for the $EF_{grid,OM,y}$, calculation was made available by the Brazilian Designated National Authority of the CDM (the Brazilian DNA), as well as $EF_{grid,BM,y}$.

<table>
<tr><td>Description of measurement methods and procedures to be applied</td><td>As per the “Tool to calculate the emission factor for an electricity system”. For this the first crediting period of the project, W_{OM} = 0.75 and W_{BM} = 0.25.

As VTRM Renewable Energy 2 uses Dispatch data analysis OM method for operating margin emission factor, $EF_{grid,OM,y}$ is calculated ex post.

For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Annually</td></tr>
<tr><td>Value monitored</td><td><table><tr><th>Year</th><th>$EF_{Grid,CM,y}$</th></tr><tr><td>01 Mar 2019 - 31 Dec 2019</td><td>0.4186</td></tr><tr><td>01 Jan 2020 - 30 Sep 2020</td><td>0.3345</td></tr></table></td></tr>
<tr><td>Monitoring equipment</td><td>Not applicable</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>As per the “Tool to calculate the emission factor for an electricity system”.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>As per the “Tool to calculate the emission factor for an electricity system”. Dispatch Data Analysis for OM Operating Margin Emission Factor. Data supplied by Brazilian CDM DNA will be used.</td></tr>
<tr><td>Comments</td><td>Detailed description for the calculation choices is presented in section 5.</td></tr>
</table>

4.3 Monitoring Plan

The monitoring plan follows the Monitoring Methodology of consolidated baseline methodology for grid-connected electricity generation from renewable sources ACM0002, version 19.0. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. All measurements are conducted with calibrated measurement equipment according to Brazilian industry standards. The main parameters monitored are:

- $EG_{facility,y}$ - Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr);

- Combined margin emission factor for the grid in year y ($EF_{Grid,CM,y}$).

Monitoring of $EG_{facility,y}$ parameter:

Operation and Maintenance (O&M) team is responsible for the operation and maintenance activities of the plants. Votorantim Energia Generation Operating Center (Centro de Operação da Geração da Votorantim Energia – COG, in Portuguese) is responsible for measurement activities. It collects and storages all measurement data. Data is collected in real time and is available at web platform.

Commercial team is responsible for monitoring and analysing $EG_{facility,y}$. information. It monitors data provided by COG and cross-check it with information provided by Chamber of Electricity Commercialization (CCEE).

Each plant has two measurement instruments (meters) located in the plant. One is the principal meter and the second is a backup meter. These meters register gross electricity generated by each plant. Substation CHAPADINHA (34.5 to 230kV), which the WPPs included in this project activity are connected to, has individual measuring equipment for each facility connected. This substation can also include energy generated by facilities outside the boundary project.

At substation Curral Novo do Piauí II (CNP2), there are two meters (one principal and one rear) that register net electricity supplied to the grid ($EG_{facility,y}$) by all 7 plants that compose the initial project instance. These meters can also include energy generated by facilities outside the project boundary. 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.

ONS Grid Procedures (Sub-module 12.3) defines the calibration frequency and other maintenance procedures. All meters of the plants are calibrated according to Brazilian Standards.

Diagram below shows the measurement scheme of VTRM Renewable Energy 2:

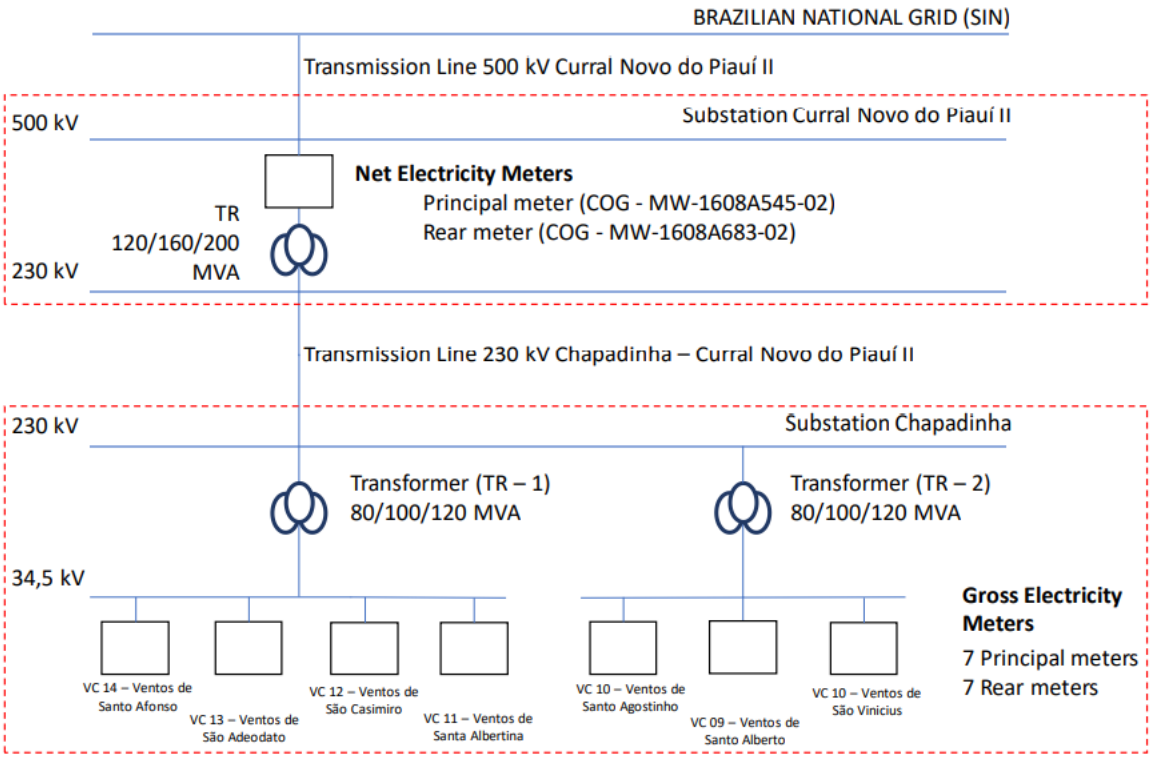

Figure 1 – Project measurement scheme

It is important to say that net electricity supplied to the grid impacts directly the revenues of the plants once electricity is the main product of the project. Therefore, a straight control is performed about this information. Periodically, the Information Technology Area accomplishes an insurance backup for all plant data through backup tape.

Monitoring of $EF_{Grid,CM,y}$:

The Combined margin emission factor for the grid in year y is calculated by consulting company hired by project proponents. Calculations follows Tool to calculate the emission factor for an electricity system, version 07.0. Data available by the Brazilian DNA is used.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad \text{Equation 1}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/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)

As VTRM Renewable Energy 2 just comprises greenfield wind power plants, then:

$$EG_{PJ,y} = EG_{facility,y} \quad \text{Equation 2}$$

Where:

$EG_{PJ,y}$	=	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)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Quantity of net electricity generation supplied by the project plant/unit to the grid

The net electricity dispatched to the grid during the monitoring period (01-March-2019 to 30-September-2020) is as follows.

Table 4 – Net electricity generation by Ventos do Piauí Complex

Month	2019	2020
January		23,671
February		31,446
March	37,570	30,023
April	40,669	47,504
May	66,338	69,658
June	98,622	92,610
July	95,734	115,144
August	111,780	115,348

September	92,619	100,853
October	84,406	
November	60,485	
December	60,658	
TOTAL	748,880	626,256

Combined margin CO_2 emission factor for grid connected power generation in year

The CO_2 emission factor of the grid is calculated by applying the following six steps of the "Tool to calculate the emission factor for an electricity system", version 07.0:

Step 1: Identify the relevant electricity systems

According to the tool, "if the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD".

The Brazilian DNA defined in 2008, through the resolution nr. 8, that the National Interconnected System should be considered a unique electricity system and that this configuration is valid for calculating the CO_2 emission factors used to estimate the greenhouse gases emissions reductions electricity generation CDM projects.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

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

The option I was chosen for the project activity, once the operation margin and build margin emission factor calculated by the Brazilian DNA or alternatively calculated by the project developer are based on data of plants connected to the grid.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple Operation Margin; or

(b) Simple adjusted Operation Margin; or

(c) Dispatch data analysis Operation Margin; or

(d) Average Operation Margin.

The method chosen analysis operation margin method.

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

The dispatch data analysis OM emission factor ($EF_{grid,OM\text{-}DD,y}$) is determined based on the power units that are actually dispatched at the margin during each hour *h* where the project is displacing electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM\text{-}DD,y}$. As consequence it will be calculated ex-post.

The $EF_{grid,OM\text{-}DD,y}$ will be calculated using the below formula:

$$EF_{grid,OM-DD,y} = \frac{\sum_{h} EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}} \qquad \text{Equation 3}$$

Where:

$EF_{grid,OM\text{-}DD,y}$	=	Dispatch data analysis operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{PJ,h}$	=	Electricity displaced by the project activity in hour *h* of the year *y* (MWh)
$feel_{,DD,h}$	=	CO_2 emission factor for 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 Brazilian DNA made availafeelIEF$_{EL,DD,h}$ parameter for determination of EF$_{grid,OM\text{-}DD,y}$ using option c) dispatch data analysis OM. Detailed information on the methods and data applied can be obtained at the DNA's website:

http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html

Considering hourly data from the BrazilifeelNA (EF$_{EL,DD,h}$) and hourly electricity generation of the project activity (EG$_{PJ,h}$), EF$_{grid,OM\text{-}DD,y}$ was calculated as follows:

Table 5 – CO2 Operating Margin Emission Factor

Year	$EF_{grid,OM,y}$
2019	0.5241
2020	0.4121
AVERAGE	0.4681

Step 5: Calculate the build margin emission factor

In terms of data vintage, project participants can choose between one of the following two options:

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second cr editing period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2. For the first crediting period, the build margin emission factor shall be updated annually, expost, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emission factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the built margin emission factor calculated for the second crediting period should be used.

The option that was chosen by project participants was Option 2.

The CO_2 build margin emission factors made available by the Brazilian DNA are as follows:

Table 6 – CO2 Build Margin Emission Factor

Year	$EF_{grid,BM,y}$
2019	0.1020
2020†	0.1020
AVERAGE	0.1020

†Data from 2019 year is used since data for 2020 year was not made available by the Brazilian DNA.

More information is presented at:

http://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despac

ho.html

Step 6: Calculate the combined margin (CM) emission factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average Combined Margin; or

(b) Simplified Combined Margin.

This Project uses option (a) to calculate the combined margin emission factor. The combined margin emission factor is calculated according to the following equation:

$$EF_{gridCM,y} = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y} \quad \text{Equation 4}$$

The following default values should be used for w_{OM} and w_{BM}:

- Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;
- All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Therefore, in accordance with the tool, the weights w_{OM} and w_{BM}, by default, are w_{BM} = 0.25 and w_{OM} = 0.75. The combined margin emission factor for each year of the monitoring period is as follows:

Table 7 – CO2 Combined Margin Emission Factor

Year	$EF_{grid,OM,y}$	$EF_{grid,BM,y}$	$EF_{grid,CM,y}$
2019	0.5241	0.1020	0.4186
2020	0.4121	0.1020	0.3345
AVERAGE	**0.4681**	**0.1020**	**0.3766**

5.2 Project Emissions

According to ACM0002: “Grid-connected electricity generation from renewable sources” (version 19.0), for most renewable energy power generation project activities, PE_y = 0. This is applied to grid-connected wind power plants as the enterprises of VTRM Renewable Energy 2.

5.3 Leakage

No other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
From 01 Mar 2019	313,453	0	0	313,453
Up to 30 Sep 2020	209,510	0	0	209,510
Total	**522,964**	**0**	**0**	**522,964**