



Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT



Title: 91 MW Sugarcane Bagasse based co-generation Energy Bioenergética AROEIRA

Version 2.0

Date June 24 , 2026

First CoU Issuance Period: 11 years and 4 months

Date: Sep 01, 2014 to Dec 31, 2025



Monitoring Report (MR) CARBON OFFSET UNIT (CoU) PROJECT

Monitoring Report

Title of the project activity	91 MW Sugarcane Bagasse based co-generation Energy Bioenergética AROEIRA
UCR Project Registration Number	587
Version	Version 2
Completion date of the MR	June 24 , 2026
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 1 Duration of this monitoring Period: (first and last days included (Sep 01,2014 to Dec 31, 2025)
Project participants	AROEIRA (OWNER) FASTCARBON (AGGREGATOR)
Host Party	Brazil
Applied methodologies and standardized baselines	CDMUNFCCC Methodology ACM0006: Electricity and heat generation from biomass (Ver.16) &UCR Standard for Emission Factor
Sectoral scopes	01- Energy industries (renewable -/ non-renewable sources)
Estimated amount of GHG emission reductions for this monitoring period in the registered PCN	2014: 4,127 CoUs (4,127 tCO ₂ eq)
	2015: 8,083 CoUs (8,083 tCO ₂ eq)
	2016: 12,544 CoUs (12,544 tCO ₂ eq)
	2017: 3,578 CoUs (3,578 tCO ₂ eq)
	2018: 9,408 CoUs (9,408 tCO ₂ eq)
	2019: 7,799 CoUs (7,799 tCO ₂ eq)
	2020: 33,461 CoUs (33,461 tCO ₂ eq)
	2021: 41,405 CoUs (41,405 tCO ₂ eq)
	2022: 27,696 CoUs (27,696 tCO ₂ eq)
	2023: 25,964 CoUs (25,964 tCO ₂ eq)
	2024: 49,028 CoUs (49,028 tCO ₂ eq)
	2025: 51,359 CoUs (51,359 tCO ₂ eq)
Total:	274,452 CoUs (274,452 tCO₂eq)

SECTION A. Description of project activity

A.1. Purpose and general description of Carbon offset Unit (CoU) project activity >>

a) Purpose of the project activity and the measures taken for GHG emission reductions >>

The project titled “91 MW Sugarcane Bagasse based co-generation Energy Bioenergética AROEIRA” is composed of a sugar cane plant, located in the city of Tupaciguara in the state of Minas Gerais, Brazil.

The project originated with the authorization granted to **Usina Bioenergética Aroeira S.A.** to establish itself as an Independent Power Producer through the development and operation of the thermoelectric power plant named “**UTE 1 – Bioenergética Aroeira**”. The project included a **6 MW generator**. Shortly after, another **10 MW generator** was also authorized at UTE 1,

In May 2020, the project was expanded with the authorization of a second UTE, featuring two generating units: UG1 with **25MW** and UG2 with **10MW**, totaling **35MW** of installed capacity, christened **UTE Energética Tupaciguara**.

Finally, a third UTE was installed and authorized to begin commercial operation in June 2024, with a generating unit UG1 of **40MW**, named **UTE Triângulo Energia**."

Unit	Installed Capacity	Location	Commercial Operation Date
UTE 01 Bioenergética Aroeira	6 MW	Tupaciguara, Minas Gerais	July 2, 2014 (Dispatch nº 2,134 - ANEEL)
UTE 01 Bioenergética Aroeira	10 MW	Tupaciguara, Minas Gerais	July 4, 2014 (Dispatch nº 2,258 - ANEEL)
UTE 02 UTE Energética Tupaciguara (CET)	35 MW (25 MW + 10 MW)	Tupaciguara, Minas Gerais	May 30, 2020 (Dispatch nº 1,544 – ANEEL)
UTE 03 Triângulo Energia	40 MW	Tupaciguara, Minas Gerais	June 11, 2024 (Dispatch nº 1,755) – ANEEL)

Below are the current environmental licenses for energy production and commercialization:

- LO Nº134 – Environmental License dated September 9, 2011, valid until September 9, 2017;
- AAF 06461/2017 Environmental License dated September 6, 2017, valid until September 6, 2021;
- LAS Nº 1002– Environmental License dated March 18, 2020, valid until March 18, 2030;
- LAS Nº 1034– Environmental License dated March 16, 2021, valid until March 16, 2031;

The details of the registered project are as follows:

Purpose of the project activity:

The purpose of the activity is to generate electricity using renewable biomass (sugarcane bagasse, which is the residue from the juice extraction process for the production of ethanol and sugar), and, thus, reduce GHG emissions by displacing fossil fuel in grid-based electricity.

It is a grid-connected biomass cogeneration power plant with a high-pressure steam-turbine configuration. The high-pressure boilers are fired by bagasse to generate steam which in turn is fed to the steam turbine to generate power. The power co-generation units generate biomass-based power for captive consumption of the sugar plant and the sale of surplus power to the Brazilian electricity grid.

The UCR Project activity is the construction and operation of power plants/units that use renewable energy sources and supplies renewable electricity to the grid. The UCR project activity is thus the displacement of electricity that would be provided to the grid by more-GHG-intensive means and provides long-term benefits to the mitigation of climate change. The UCR project activity qualifies under the environmental additional positive list of pre-approved project types under the UCR carbon incentive model for issuance of voluntary carbon credits.

Usina Bioenergética Aroeira was established on October 10, 2006. Based on a modular project, the Industrial Unit was initially designed to process up to 3,000 tons of sugarcane per day, totaling approximately 2.7 million tons per harvest season in its operational phase. The effective operation of Bioenergética Aroeira began in the 2009/2010 harvest year, progressively expanding its crushing capacity.

Important Timeline:

- October 10, 2006 - Company foundation (CNPJ registration)
- July 12, 2008 - Groundbreaking ceremony (construction start)
- 2009/2010 - Industrial operations start
- June 27, 2011 - Corporate transformation to Bioenergética Aroeira S.A.



<https://www.bioaroeira.com.br/quem-somos/>

The company has experienced steady growth in its crushing capacity each year. In the 2019/2020 harvest, the mill processed 2.65 million tons of sugarcane, representing an increase of 450,000 tons compared to the previous harvest. This growth trajectory continued with significant operational milestones: in May 2024, Aroeira achieved a daily crushing record of 18,673.52 tons in a single day, surpassing the 2024 Harvest Plan target of 18,100 tons per day. Additionally, in the same month, the mill reached a monthly crushing record of 503,775.54 tons, exceeding the previous record of 463,443.50 tons achieved in July 2023.

Regarding bioelectricity generation, in 2020, the mill produced 208,200 MWh of energy, with 137,800 MWh exported to the grid, representing 66.18% of total production. In 2021, total production reached 46,173 MWh, with 34,835 MWh exported (75.4% of production). The exported energy is sufficient to supply thousands of households in the region, contributing significantly to Brazil's renewable energy matrix and reducing dependence on fossil fuels.

Tupaciguara Plant:

Usina Bioenergética Aroeira S.A. operates across multiple business segments, including the production of high-quality VHP sugar and ethanol (both anhydrous and hydrated) from sugarcane, the generation of renewable bioelectricity through biomass cogeneration power plants utilizing sugarcane bagasse, and the production of vinasse and filter cake as organic fertilizers for agricultural use.





b) Brief description of the installed technology and equipment>>

1. Implementation Status of the Project Activity

The Usina Bioenergética Aroeira project is a 91 MW sugarcane bagasse-based cogeneration energy system composed of:

UTE 01 – Bioenergética Aroeira, UG-1 e UG-2: 16 MW operational since July 2, 2014.

UTE 02 – Energética Tupaciguara (CET), UG-3 e UG-4: 35 MW, operational since May 30, 2020.

UTE 03 – Triângulo Energia, UG-5: 40 MW, operational since June 11, 2024.

The project is fully implemented and operational, supplying renewable electricity to the Brazilian national grid and for captive consumption within the industrial units.

2. Installed Technology and Equipment

The project activity is a grid-connected biomass cogeneration power plant, using high-pressure steam turbine technology. The process follows the Rankine cycle for efficient energy conversion, with the main steps as follows:

Combustion of Sugarcane Bagasse: Biomass residue from sugarcane processing is burned in high-pressure boilers.

Steam Generation: The combustion process generates steam at high temperatures and pressure.

Electricity Generation: The steam drives high-efficiency extraction-condensing steam turbines, which are connected to alternators to produce electricity.

Main Components:

Boilers:

Nº 01 (Mitre): 100 TPH (tons per hour), 42 kgf/cm², 400°C.

Nº 02 (Caldema): 140 TPH (tons per hour), 67 kgf/cm², 520°C.

Nº 03 (Caldema): 250 TPH (tons per hour), 67 kgf/cm², 520°C.

Turbines:

Nº 01 (TGM Turbinas): 6,305 kW, 42.00 bar, 400°C.

Nº 02 (TGM Turbinas): 10,488 kW, 42.00 bar, 400°C.
Nº 03 (TGM Turbinas): 25,900 kW, 65.00 bar, 515°C.
Nº 04 (TGM Turbinas): 10,456 kW, 65.00 bar, 515°C.
Nº 05 (TGM Turbinas): 41,549 kW, 64.74 bar, 510°C.

Alternators (WEG):

Nº 01 (WEG): 6,000 kW, PF: 0.8, 13,800 V, 60 Hz.
Nº 02 (WEG): 10,000 kW, PF: 0.8, 13,800 V, 60 Hz.
Nº 03 (WEG): 25,000 kW, PF: 0.8, 13,800 V, 60 Hz.
Nº 04 (WEG): 10,000 kW, PF: 0.9, 13,800 V, 60 Hz.
Nº 05 (WEG): 40,000 kW, PF: 0.8, 13,800 V, 60 Hz.

Auxiliary Systems:

Fuel and ash handling equipment.
Water-cooled condenser system.
Electrical and automation systems.

c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.)>>

The Usina Bioenergética Aroeira project consists of one biomass cogeneration plants that have been operational for several years, supplying renewable electricity to the Brazilian national grid and for captive consumption. The relevant dates for the project activity are as follows:

Unit	Last License Date / Validity	Commercial Operation Date
UTE 1 - Bioenergética Aroeira	March 18, 2020 / March 18, 2030	July 2, 2014
UTE 2 - Energética Tupaciguara (CET)	March 18, 2020 / March 18, 2030	May 30, 2020
UTE 3 - Triângulo Energia	March 16, 2021 / March 18, 2031	June 11, 2024

UCR Project ID: UCR ID Number: 587

Start Date of Crediting Period: Sep 01, 2014.

End Date of Crediting Period: Dec 31, 2025

Monitoring Period: Sep 01, 2014 to Dec 31, 2025.

The project has been in continued operation since its commissioning, consistently generating renewable energy and contributing to greenhouse gas (GHG) emission reductions through the displacement of fossil fuel-based electricity.

d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

The total GHG emission reductions achieved in this monitoring period is as follows:

Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of this Monitoring Period	Sep 01, 2014
Carbon credits claimed up to	Dec 31, 2025
Total ERs generated (tCO _{2eq})	274,452 tCO _{2eq}
Leakage	0

e) Baseline Scenario>>

The electricity supplied to the grid by the Usina Bioenergética Aroeira (project activity) would have otherwise been generated by fossil-fuel-fed powerplants connected to the national grid, which are carbon intensive sources of electricity generation.

In the absence of renewable energy generation from biomass, the Brazilian electrical grid would need to increase reliance on fossil fuel-fired thermal power plants to meet electricity demand.

A.2. Location of project activity>>

Country: Brazil
District: Tupaciguara
State: Minas Gerais
Zip Code: 38200-000
Latitude: -18.7564°
Longitude: -48.6114°



A.3. Parties and project participants >>

Party (Host)	Participants
Brazil	Owner: USINA BIONERGÉTICA AROEIRA Rodovia BR 452, km 77, S/N, Zona Rural., Tupaciguara - MG, Zip Code: 38480-000 https://www.bioaroeira.com.br/ Aggregator: FastCarbon Consultoria e Negócios Ltda Rua Viradouro, 63, conjunto 61, Itaim Bibi São Paulo/SP Zip Code: 04538-110 https://fastcarbon.com.br

A.4. References to methodologies and standardized baselines >>

SECTORAL SCOPE: 01 – Energy industries (Renewable/Non-renewable sources)

TYPE: I - Larger renewable energy or energy efficiency projects. (Biomass Energy)

CATEGORY: CDMUNFCCC Methodology ACM0006: Electricity and heat generation from biomass (Ver.16) &UCR Standard for Emission Factor

Applied Standardized Baselines:

The project follows the UCR Standard for Emission Factor, using the combined margin emission factor for the Brazilian electricity grid, as defined by the UNFCCC methodology:

Tool to calculate the emission factor for an electricity system (Version 7.0)

The grid emission factor is calculated as per the methodology defined in this tool.

Reference: UNFCCC CDM Tool.

(<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>)

Applicability of Methodologies and Standardized Baselines

The project meets all applicability conditions of the selected methodology.

The project activity is a biomass (bagasse)-based cogeneration system, generating both electricity and process heat, and exporting surplus electricity to the grid.

The biomass used (sugarcane bagasse) is a residue from the sugar and ethanol production process and does not come from dedicated plantations.

The project does not involve co-firing of fossil fuels beyond the allowed limit ($\leq 25\%$) as per UCR protocol.

Neither diesel nor fossil fuels are used. Only sugarcane bagasse (renewable biomass residue) and eucalyptus wood (renewable biomass, applied once a year for boiler ignition) are combusted. Complies with ACM0006 §5.6.

The project displaces grid electricity that would otherwise be generated using fossil fuels, thus contributing to GHG emission reductions.

The total installed capacity of 91 MW qualifies under the large-scale methodology ACM0006, and the emissions are capped accordingly.

The project fully complies with UCR and UNFCCC methodologies, ensuring robust and transparent emission reduction calculations.

A.5. Crediting period of project activity >>

Length of the crediting period corresponding to this monitoring period: 11 years and 4 months – Sep 01, 2014 - Dec 31, 2025

A.6. Contact information of responsible persons/entities >>

Name: Fábio Bressani Ribeiro
Company (Aggregator): FastCarbon
Mobile: +55 11 99884 6428
E-mail: fabio.bressani@fastcarbon.com.br

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity >>

a) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

Usina Bioenergética Aroeira S.A. was established on October 10, 2006. Based on a modular project, the Industrial Unit was initially designed to process up to 3,000 tons of sugarcane per day, totaling approximately 2.7 million tons per harvest season in its operational phase. The effective operation of Bioenergética Aroeira began in the 2009/2010 harvest year, progressively expanding its crushing capacity.

The authorization for grid power injection from the National Electrical Energy Agency (ANEEL) for the first Generator Unit, with 6 MW, was granted on July 1, 2014, and shortly after, another 10 MW unit, thus forming UTE 01, Bioenergética Aroeira.

Subsequently, in May 2020, it obtained authorization for UTE 02, Energética Tupaciguara (CET), with two generating units of 25,000 kW and 10,000 kW, totaling 35,000 kW.

Finally, in June 2024, it obtained authorization for the 40,000-kW generating unit, forming UTE 03, Triângulo Energia.

Below are the orders, ordinances and resolutions that were obtained in chronological order, documents that are public and available for verification:

- AUTHORIZING RESOLUTION No. 2,490, OF JULY 27, 2010:

Authorization to establish itself as a Self-Producer of Electric Energy, consisting of two generating units of 10,000 kW and 5,000 kW, totaling 15,000 kW of installed capacity, using sugarcane bagasse as fuel.

- DISPATCH No. 3,432, OF NOVEMBER 10, 2010:

Authorization of the 10,000 kW generating unit for the start of test operation. Start of tests: November 11, 2010.

- DISPATCH No. 1,674, OF MAY 29, 2014:

Authorization of the 6,000 kW generating unit for the start of test operation. Start of tests: May 30, 2014.

- DISPATCH No. 2,134, OF JULY 1, 2014:

Authorization of the 6,000 kW generating unit for the start of commercial operation. Start of commercial operation: July 2, 2014.

- DISPATCH No. 2,258, OF JULY 3, 2014:

Authorization of the 10,000 kW generating unit for the start of commercial operation. Start of commercial operation: July 4, 2014.

- Ministerial Ordinance of the Ministry of Mines and Energy No. 235 / 2018

Authorization to establish itself as a Self-Producer of Electric Energy, consisting of two generating units of 25,000 kW and 10,000 kW, using sugarcane bagasse as fuel Authorization as Self-Producer 35,000 kW

- DISPATCH No. 1,392, OF MAY 18, 2020:

Authorization of the two generating units of 25,000 kW and 10,000 kW, totaling 35,000 kW for the start of test operation. Start of tests: May 19, 2020.

- DISPATCH No. 1,544, OF MAY 29, 2020:

Authorization of the two generating units of 25,000 kW and 10,000 kW, totaling 35,000 kW for the start of commercial operation. Start of commercial operation: May 30, 2020.

- AUTHORIZING RESOLUTION No. 10,266, OF JULY 6, 2021:

Authorization to establish itself as a Self-Producer of Electric Energy, consisting of one generating units of 40,000 kW, using sugarcane bagasse as fuel.

- DISPATCH No. 1,269, OF APRIL 19, 2024:

Authorization of the generating unit of 40,000 kW for the start of test operation. Start of tests: April 20, 2024.

- DISPATCH No. 1,755, OF JUNE 10, 2024:

Authorization of the 40,000-kW generating unit for the start of commercial operation. Start of commercial operation: June 11, 2024.

b) For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate>>

The UCR project activity is a grid-connected bagasse-based cogeneration power plant with a high-pressure steam-turbine configuration. The UCR project activity is the electricity generation capacity

and the installation of facilities for allowing captive use and export of electricity to the electricity grid.

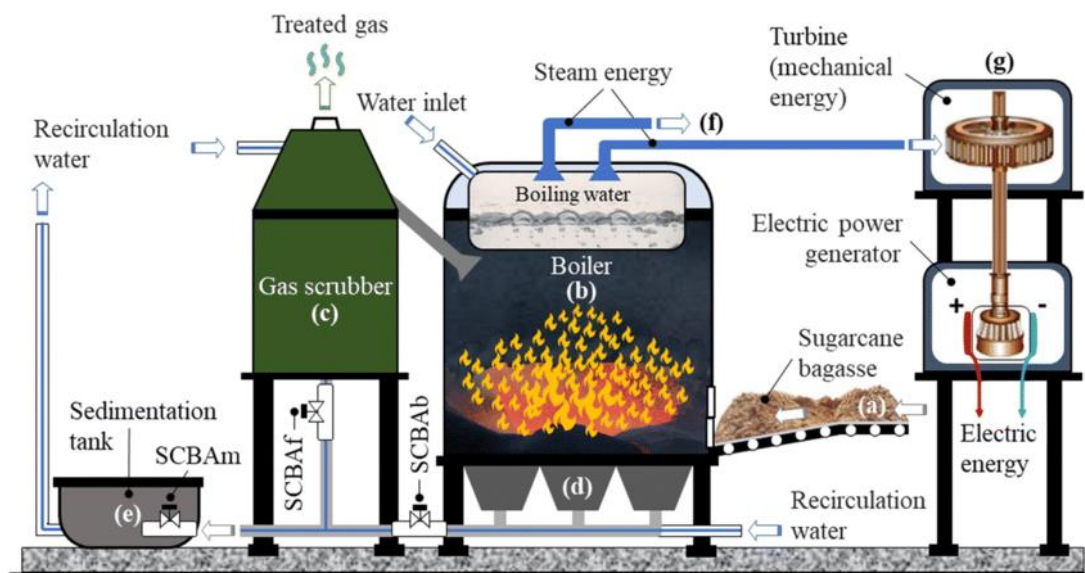
The primary technology for the project activity is direct combustion of biomass residues, and power generation using the Rankine cycle technology. Power generation through this method involves combustion of biomass residues directly in the boiler, which is capable to generate high-pressure high-temperature steam, which is fed to a steam turbine that drives a generator.

The main elements of the power plant are as follows.

- A boiler unit which converts the energy available in the fuels into thermal energy;
- A steam turbine unit which converts thermal energy into mechanical energy;
- An alternator unit, which converts mechanical energy into electrical power.

A number of other equipment components, as listed below, also form part of the biomass power plant.

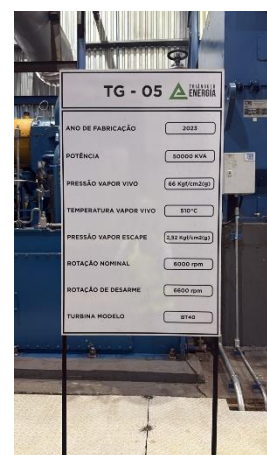
- Fuel and ash handling equipment
- Water cooled condenser system for cooling the exhaust steam
- DM Water system and Air Compressor Plant
- Electrical systems and Automation system



Photographs of the Aroeira Sugarcane Mill



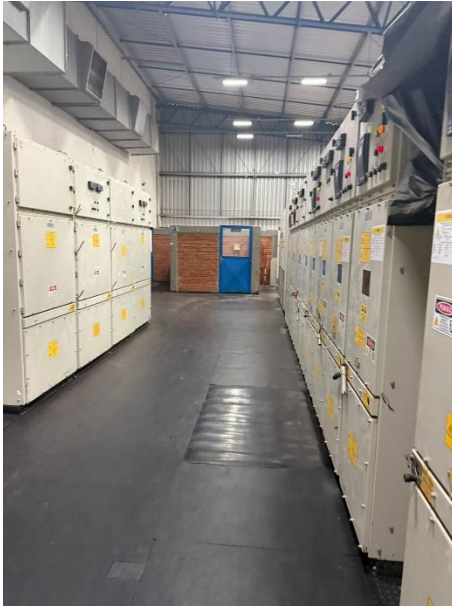
Thermal Generation Center



Generators



Boilers



Electrical Systems



Generators



Generator nº 2



Generator n° 3



Generator n° 4



Generator nº 5

The system consists of five power-generating units supplied by two boilers. Boilers nº. 1 is currently switched off and serves only as a backup in case there are any problems with the other two. For turbines 1 and 2, there is a pressure reducer from 65 to 42 kgf/cm² when fed by boilers 2 and 3.

Boiler	Nº 01	Nº 02	Nº 03
Manufacturer	MITRE	CALDEMA	CALDEMA
Capacity (Tons/h)	100	140	250
Serial number	MPB-100-09120	164 / 2018	184 / 2023
Year of manufacturer	2009	2018	2023
Maximum allowable working pressure (kgf/cm ² g)	48	80	80
Hydrostatic Test Pressure (kgf/cm ² g)	72	120	120
Pressure (kgf/cm ²)	42	67	67
Degree of super heat °C (Steam)	400	520	520
Heating surface area (m ²)	2,200	2,686	6,881
Design Standard	ASME I -2004	ASME I -2017	ASME I -2021
category	A	A	A



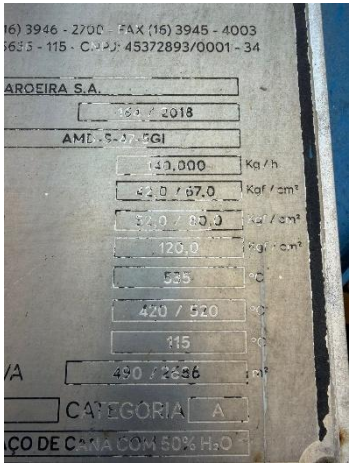
Boiler nº 1



Boiler nº 2



Boiler nº 3

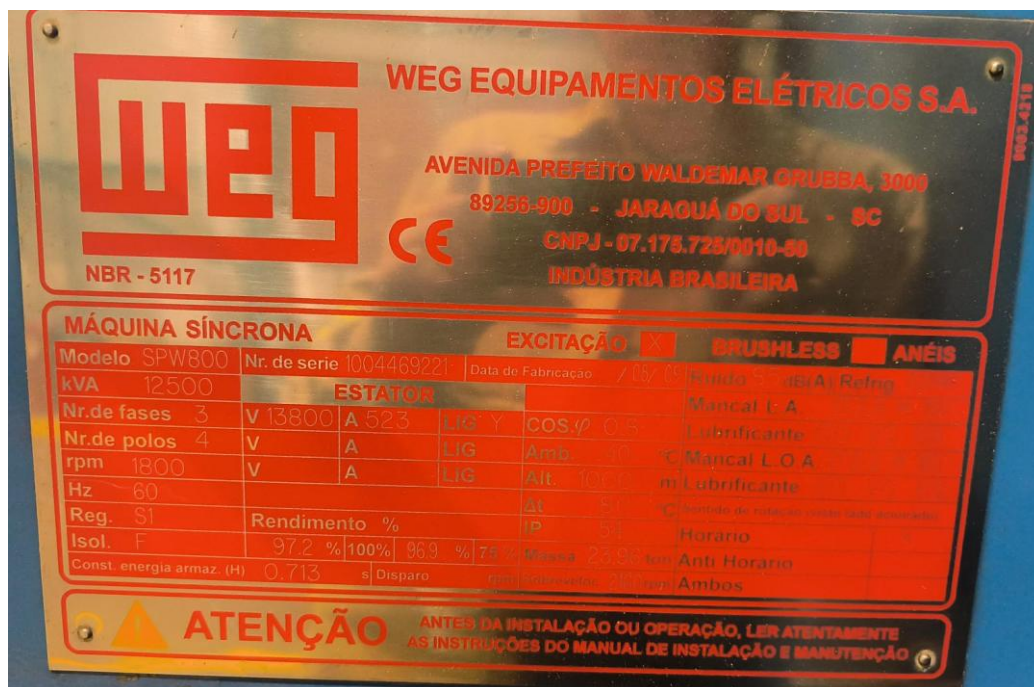


Boiler nº 2

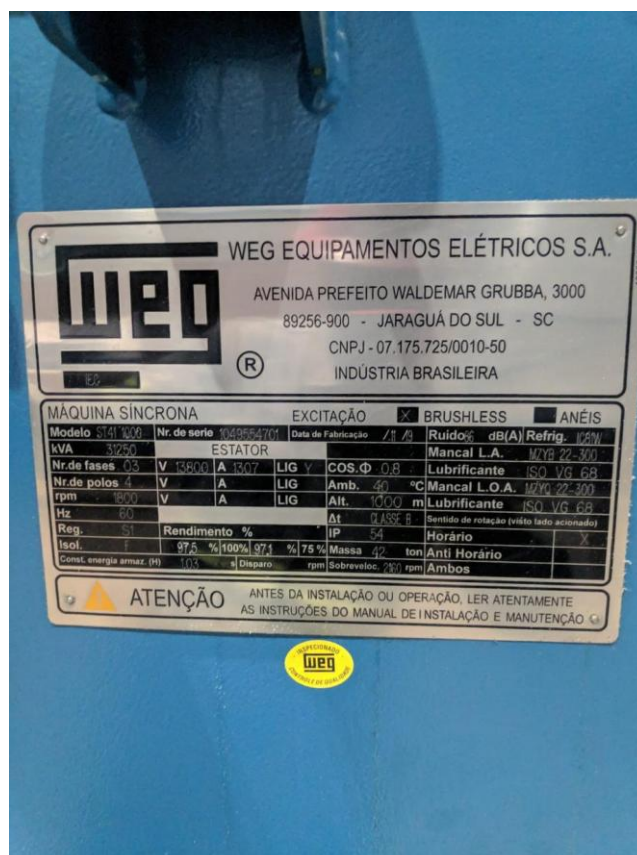
Alternator/ Generator	Nº 1	Nº 2	Nº 3	Nº 4	Nº 5
Year of manufacturer	August, 2013	August, 2009	November, 2019	November, 2019	May, 2023
Manufacturer	WEG	WEG	WEG	WEG	WEG
Power Rated (kVA)	7,500	12,500	31,250	12,500	50,000
Serial Number	1020139401	1004469221	1049554701	1050886711	1082268008
Voltage (V)	13,800	13,800	13,800	13,800	13,800
Current (Amps)	313.8	523	1,307	523	2,092
Power Factor (cos ϕ)	0.80	0.80	0.80	0.80	0.80
Efficiency (75%, 100% of load)	95.9%, 96.2%	96.9%, 97.2%	97.1%, 97.5%	96.7%, 96.9%	97.5%, 97.7%
Generator Rated Speed (rpm)	1,800	1,800	1,800	1,800	1,800
Frequency (Hz)	60	60	60	60	60
Generator Model	ST40-07C0PV	SPW800	ST41-1000	ST41-710	ST41-1120



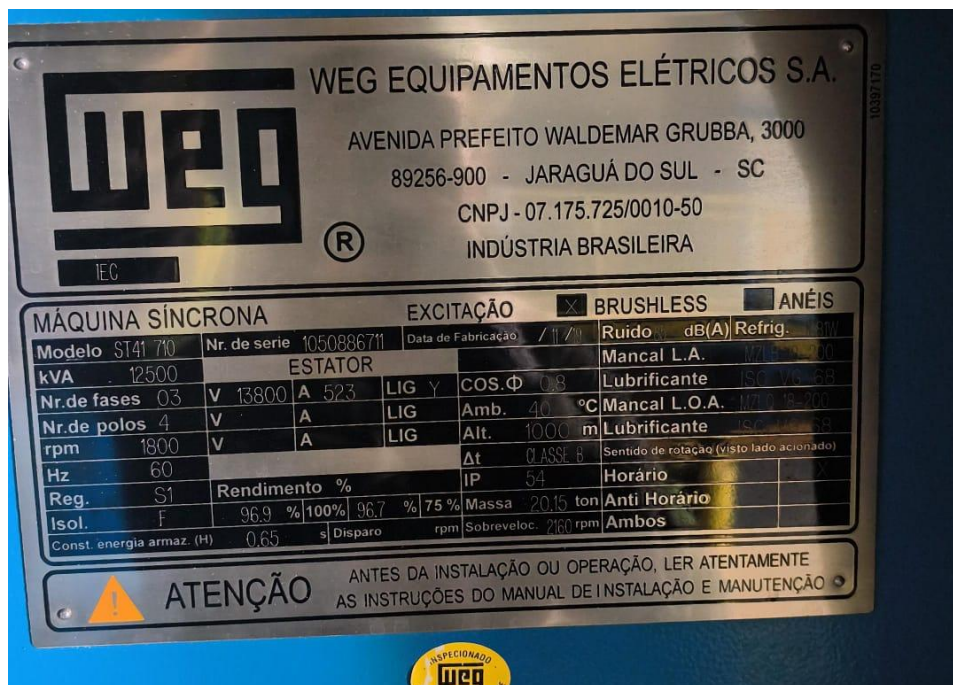
Alternator/ Generator nº 1 – UTE 01



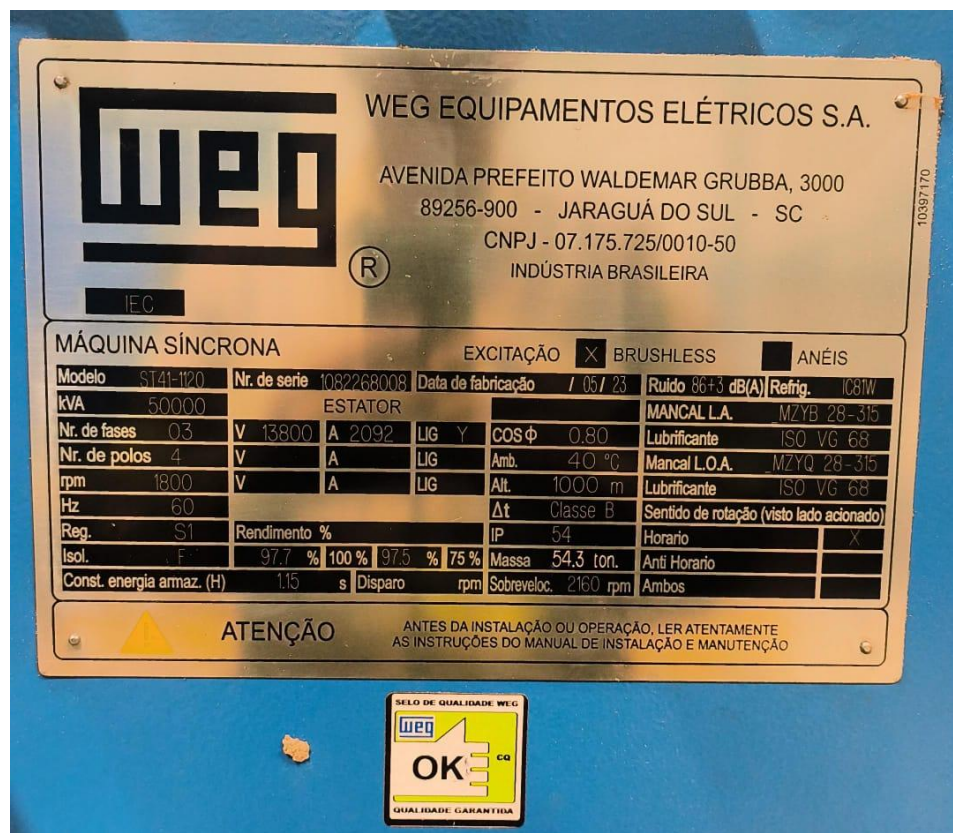
Alternator/ Generator nº 2 – UTE 02



Alternator/ Generator nº 3 – UTE 02



Alternator/ Generator nº 4 – UTE 02



Alternator/ Generator nº 5 – UTE 03

Turbine	Nº 1	Nº 2	Nº 3	Nº 4	Nº 5
Year of manufacturer	2013	2009	2019	2020	2023
Manufacturer	TGM Turbinas	TGM Turbinas	TGM Turbinas	TGM Turbinas	TGM Turbinas
Power Rated (kW)	6,305	10,488	25,900	10,456	41,549
Live Steam Pressure (Bar)	42	42	65	65	64.74
Live Steam Temperature (°C)	400	400	515	515	510
Steam Exhaust Pressure (Bar)	1.5	1.5	2.47	0.10	2.47
Turbine Rated Speed (rpm)	6,500	8,000	6,000	9,600	6,000
Turbine Disarm Speed (rpm)	7,150	8,800	6,600	10,560	6,600
Turbine Model	TM 5000	TM 10000	TM 25.000A	CT 25F	BT40

TGM TURBINAS SERTÃOZINHO - SP CEP 14175-000
FONE 55 13 2195-2300 **BRASIL**

Ano de Fabricação 2013 OS 1441147

Potência (acoplamento) 6305 kW

Pressão Vapor Admissão 42 kgf/cm²(g)

Temperatura Vapor Admissão 400 °C

Pressão Vapor Escape 1,5 kgf/cm²(g)

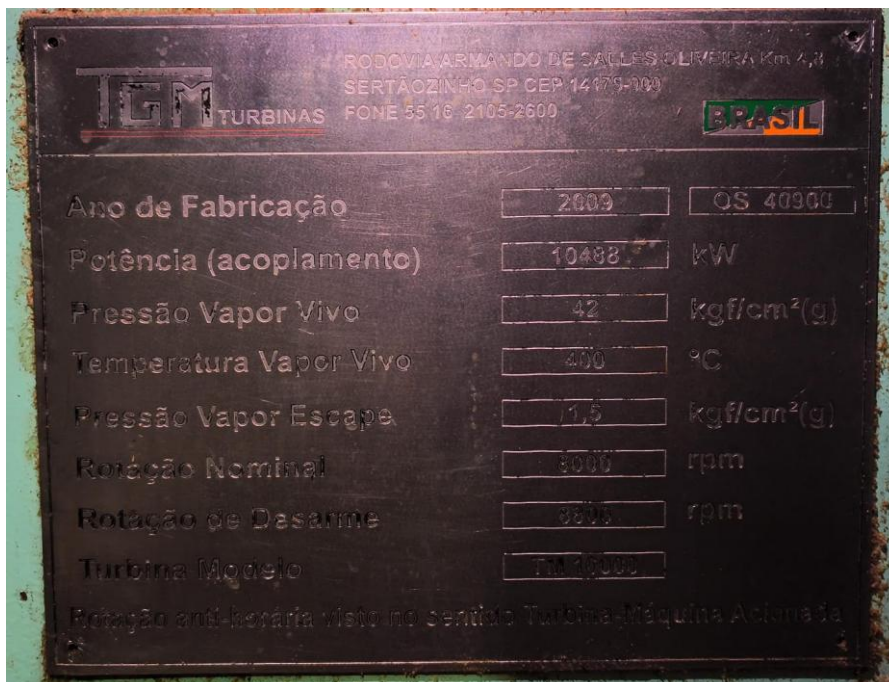
Rotação Nominal 6500 rpm

Rotação de Desarme 7150 rpm

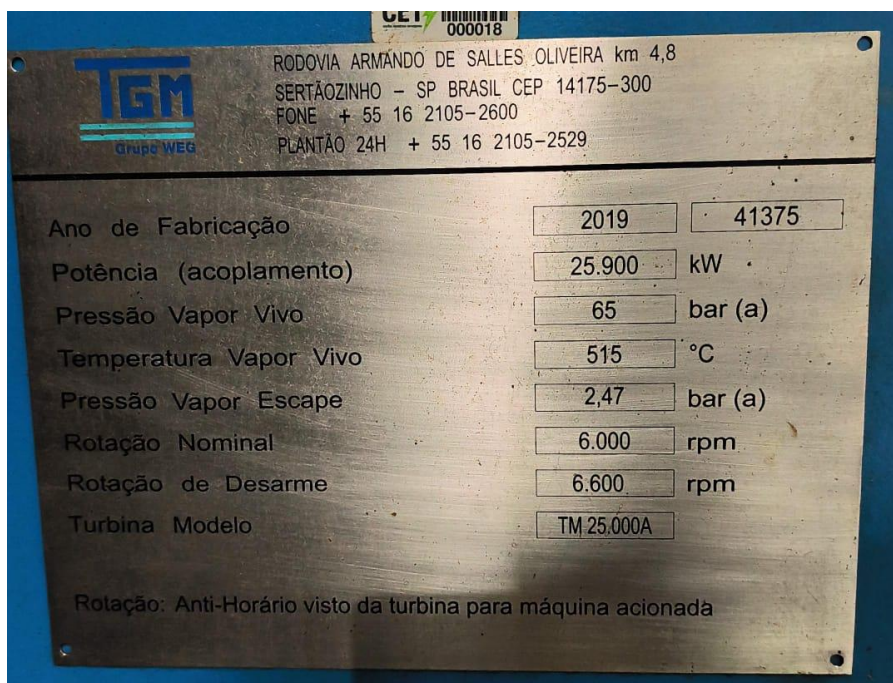
Turbina Modelo TM 5000

Rotação anti-horária visto no sentido Turbina - Máquina Acionada

Turbine nº 1 – UTE 01



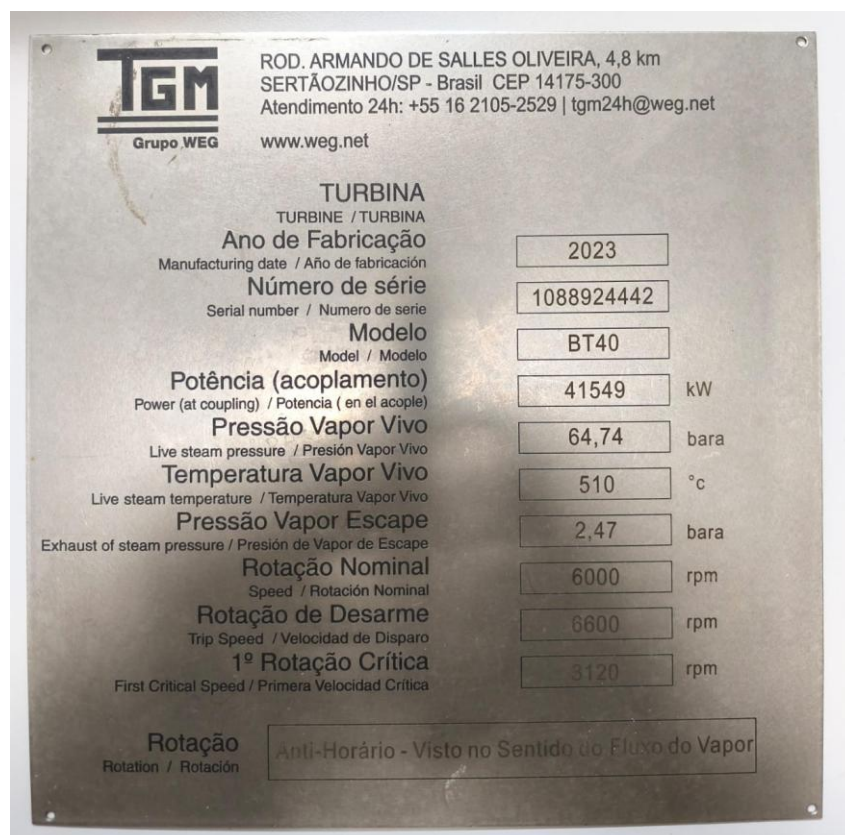
Turbine nº 2 – UTE 02



Turbine nº 3 – UTE 02

		RODOVIA ARMANDO DE SALLES OLIVEIRA km 4,8 SERTÃOZINHO - SP BRASIL CEP 14175-300 FONE + 55 16 2105-2600 PLANTÃO 24H + 55 16 2105-2529	
Ano de Fabricação	2020	41376	
Potência (acoplamento)	10.456	kW	
Pressão Vapor Vivo	65	bar (a)	
Temperatura Vapor Vivo	515	°C	
Pressão Vapor Escape	0,10	bar (a)	
Rotação Nominal	9.600	rpm	
Rotação de Desarme	10.560	rpm	
Turbina Modelo	CT 25F		
Rotação: Horário visto na direção do fluxo de vapor.			

Turbine nº 4 – UTE 02



Turbine nº 5 – UTE 03

B.2 Do no harm or Impact test of the project activity>>

There are social, environmental, economic and technological benefits which contribute to sustainable development.

- **Social benefits:**

- Creation of direct and indirect jobs (1,500+ employees), with priority for local hiring in the municipality of Tupaciguara and surrounding regions in Minas Gerais.
- Training and professional qualification programs in partnership with local educational institutions, strengthening workforce skills and technical capabilities for employees and community members.
- Health and safety initiatives, including medical and hospital assistance, dental care, pharmaceutical support, and occupational health programs for all employees.
- Improvement of local quality of life through community projects such as Projeto Futsal Aroeira (serving 6–14-year-old children), Projeto Balé Aroeira (approximately 80 children aged 8-16), and Projeto de Danças Urbanas Aroeira (approximately 40 children aged 8-16), promoting social inclusion through sports and culture.
- Infrastructure improvements for the community, including the renovation of the "Dimas Cardoso" Sports Court in Paineiras neighborhood, providing renewed spaces for sports and recreation.

- **Environmental benefits:**

- Renewable energy generation from sugarcane biomass (bagasse), reducing dependence on fossil fuels and contributing clean energy to the local grid.
 - Carbon neutrality through ethanol production from sugarcane, significantly reducing greenhouse gas emissions compared to fossil fuels.
 - Bonsucro certification, demonstrating compliance with global sustainability standards in sugarcane production across 53 rigorous indicators.
 - Efficient waste management through co-generation systems, maximizing resource utilization and minimizing environmental impact.
- Sustainable agricultural practices that support soil health and biodiversity conservation in the Cerrado region.

- **Economic benefits:**

- Production of renewable biofuels (anhydrous and hydrated ethanol) and VHP sugar, contributing to Brazil's energy security and agricultural exports.
- Bioelectricity generation surplus sold to the national grid, providing additional revenue streams and energy reliability.
- Significant investments in local economy through direct employment, supplier contracts, and infrastructure development in Tupaciguara region.
- Tax contributions at municipal and state levels, strengthening public services in health, education, and infrastructure.
- Technology-driven efficiency improvements projected to generate R\$ 100 million in value over three years through innovation initiatives.
- Implementation of modern agricultural and industrial processes aligned with international sustainability standards.
- Continuous innovation in bioenergy production, maximizing energy efficiency and resource optimization.
- Integration of sustainable farming technologies supporting long-term productivity and environmental stewardship.



Winter Clothing Drive



Technical Visit - UFU Students



Agro Women's Meeting

Fraternal Comfort Project

Developing New Talent



'Women of Industry' and 'Agro Energy Comes from Them' Projects

Sustainable Use of Natural Resources



Composting Yard



Agricultural Management System (Agrion)

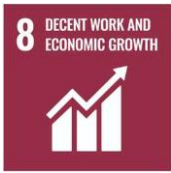


Improve road safety and access to cities.

Usina Bioenergética Aroeira contributes significantly to economic, environmental and social matters, however, it stands out as it contributed to 16 SDG's.

SDG	Target	How was it achieved?
	1.1 – By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.90 a day 1.3 – Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable 1.5 – By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	Job creation (>1,000 employees) and economic contribution to local communities through taxes, local hiring, and partnerships. Fraternal Comfort Project, a solidarity initiative focused on providing emotional comfort, care, and basic needs to vulnerable people. Maintains an ongoing donation program, in accordance with the donation policy. Winter Clothing Drive Christmas Food Basket Donations Hilda Vilela Elderly Shelter
	2.2 - By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons 2.4 - By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	Rotary Milk Bank Campaign Adoption of sustainable agricultural practices, increase in area applied with localized vinasse and reduction in potassium chloride application, consumption of organomineral fertilizer only – planting, consumption of organomineral fertilizer only – Ratoon, reduction of nitrogen fertilizer application in fertigated areas and Reduction of trampling (soil compaction). Regenerative agricultural practice (Use of green manure).
	3.1 - By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births 3.8 - Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	Better Maternity (prenatal monitoring, free and unlimited 24/7 care for pregnant women and newborns, plus a 100.00 card benefit after the baby's birth). Breathe Well Project (monitoring and treatment for smokers, with free supply of medication throughout the entire treatment). EAP (Employee Assistance Program), with free medical, nutritional, and psychological

	3.9 – By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination 3.a - Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate	consultations for employees and family members. Plus, financial and legal counseling. RPP (Respiratory Protection Program) - a means of controlling roles with respiratory risk, based on respiratory history and mask fit testing.
	4.3 - By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, at affordable prices, including university 4.4 - By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship 4.7 - By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	Bioenergética Aroeira's Scholarship Program for employees, free short courses in partnership with colleges, and Technical Visits for UFU Students. Monte Alegre de Minas Cultural Project Year-End Presentation Sports projects, with donation of uniforms and encouragement of practice."
	5.1 – End all forms of discrimination against all women and girls everywhere 5.5 - Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	Adoption of a Code of Ethics and Conduct and a Human Resources Policy that prohibit any type of discrimination, including gender discrimination. Campaign and publications: Women of Sugarcane, which promotes and confirms the rise of female participation in the bioenergy sector.
	6.3 - By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally 6.4 - By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable	Increase water-use efficiency, water reuse, smart irrigation, and water monitoring to reduce withdrawal and waste. Protect aquatic ecosystems

	withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity 6.6 - By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix.	Clean Energy Generation
	8.3 - Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services. 8.8 - Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	Generation of more than 1,000 direct and indirect jobs, PAS (Safe Attitude Program) and Befit initiatives, occupational health and safety policies, HR and training. Master Cana Social Award, recognizes and encourages excellence in human resources management and social responsibility within the bioenergy sector. By honoring companies that prioritize employee well-being, safety, and professional development, the award directly promotes the protection of labor rights and the maintenance of safe and secure working environments for all employees
	9.1 - Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all 9.4 - By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	Agricultural Management System (Agrion), investments in automation, digitalization, and low environmental impact processes. Modernized processes and energy efficiency at every stage. Reintroduction of industrial residues (filter cake and ash) into the production process as agricultural inputs. Innovation projects BioAroeira Technology and Innovation Week

	10.4 – Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	Living wage policy, workforce covered by benefits, and salary review policy.
	11.2 - By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons 11.4 - Strengthen efforts to protect and safeguard the world's cultural and natural heritage 11.5 - By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	Rural road rehabilitation and maintenance: the plant performs maintenance on the rural road network, which directly benefits local residents' traffic and access to the city. Holding cultural events in public squares promotes the appreciation of local culture, community leisure, and the positive use of public spaces. Fire brigades and monitoring teams that, in addition to protecting the crops, safeguard rural areas and the city of Tupaciguara against uncontrolled fires.
	12.2 - By 2030, achieve the sustainable management and efficient use of natural resources 12.4 - By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment 12.5 - By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	100% employee environmental engagement; reduce water, energy, and fuel consumption in operations and events Sustainable use of natural resources, waste generation reduction, management of chemicals and waste. Composting Yard: recycling and reuse of industrial by-products (filter cake and ash), transforming what would be considered waste into a valuable input (fertilizer), avoiding disposal into the environment and reducing the need to purchase new chemical fertilizers.
	13.1 - Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries 13.2 - Integrate climate change measures into national policies, strategies and planning.	Production of ethanol, a less polluting fuel than others such as gasoline and diesel. Investments in energy efficiency and GHG reduction.

	15.1 - By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. 15.5 - Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.	Recovery and improvements in PPA (Permanent Preservation Areas) and LR (Legal Reserve) areas within compensatory measure execution zones and processes for forming ecological corridors between fragments. Fauna Monitoring Program.
	16.1 - Significantly reduce all forms of violence and related death rates everywhere 16.5 - Substantially reduce corruption and bribery in all their forms 16.6 - Develop effective, accountable and transparent institutions at all levels	Code of Ethics, Whistleblowing Channel (operated independently), ESG Committee and structured corporate governance. Whistleblowing Channel
	17.16 - Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries 17.17 - Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	Partnerships with universities, research centers, and suppliers for innovation in ethanol, VHP sugar, and cogeneration (Innovation Week)

B.3. Baseline Emissions>>

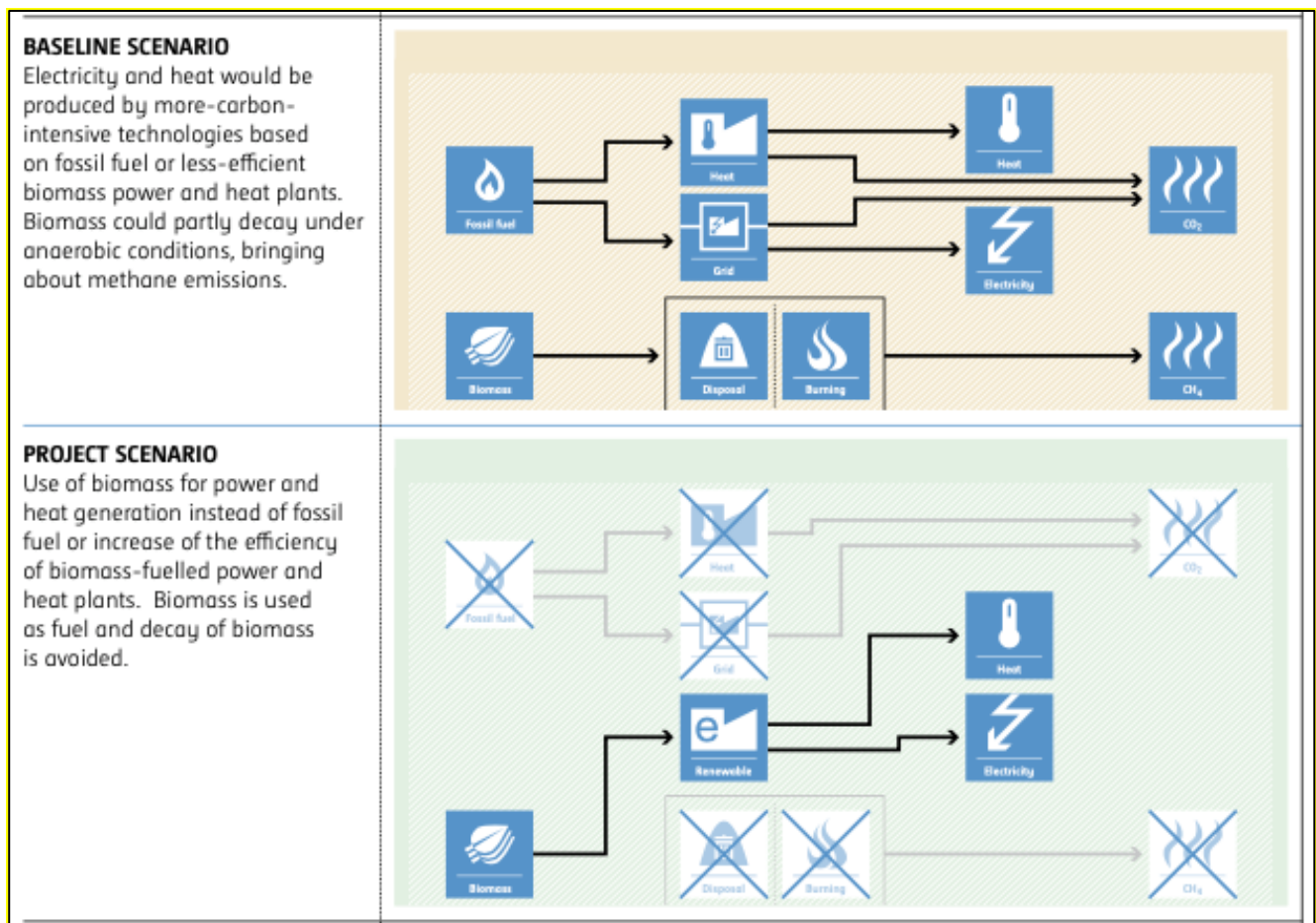
The baseline scenario identified in this Monitoring Report of the project activity is:

The approved baseline methodology has been referred from the indicative simplified baseline and monitoring methodologies for selected large scale UNFCCC CDM project activities that involve generation of power and heat in thermal power plants, including cogeneration plants using biomass.

Typical activities under ACM0006 are new plants, capacity expansions, energy efficiency improvements or fuel switch projects.

The electricity supplied to the grid by the Usina Bioenergética Aroeira S.A. (project activity) would have otherwise been generated by fossil-fuel-fed powerplants connected to the national grid, which are carbon intensive sources of electricity generation.

ACM0006 Electricity and heat generation from biomass



Thus, this project activity was a voluntary investment which replaced equivalent amount of electricity from the Brazilian grid. The project proponent was not bound to incur this investment as it was not mandatory by national and sectoral policies. Thus, the continued operation of the project activity would continue to replace fossil fuel-based power plants and fight against the impacts of climate change. The Project Proponent hopes that carbon revenues from 2014-2025 accumulated as a result of carbon credits generated will help repay the investments and help in the continued maintenance of this project activity.

B.4. Debundling>>

This “91 MW Sugarcane Bagasse based co-generation Energy Bioenergética AROEIRA” project is not a debundled component of a larger project activity.

There is no registered large-scale UCR project activity or a request for registration by another small-scale project activity:

- By the same project participants;
- In the same project category and technology/measure; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION C. Application of methodologies and standardized baselines

C.1. References to methodologies and standardized baselines >>

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-renewable sources)

TYPE I - Larger renewable energy or energy efficiency projects. (Biomass Energy)

CATEGORY - ACM0006: “Electricity and heat generation from biomass” Version 16.0 & UCR Standard for Emission Factor

C.2. Applicability of methodologies and standardized baselines >>

This methodology is applicable to project activities that operate biomass (co-gen) fired power and heat plants.

Applicability Criteria	Applicability status
This methodology is applicable to project activities that operate biomass (co-)fired power-and-heat plants. The CDM project activity may include the following activities or, where applicable, combinations of these activities: (a) The installation of new plants at a site where currently no power or heat generation occurs (Greenfield projects); (b) The installation of new plants at a site where currently power or heat generation occurs. The new plant replaces or is operated next to existing plants (capacity expansion projects); (c) The improvement of energy efficiency of existing biomass-based power-and-heat	The project activity is a power generation project using a biomass (bagasse) and displaces CO2 emissions from electricity generation in power plants that are displaced due to the project activity. Since the project activity utilizes biomass (bagasse) for the generation of power and supplies it to the local grid, it displaces fossil fuel, and hence it meets the primary applicability criteria of the methodology.

plants (energy efficiency improvement projects), which can also lead to a capacity expansion, e.g. by retrofitting the existing plant; (d) The total or partial replacement of fossil fuels by biomass in existing power-and-heat plants or in new power-and-heat plants that would have been built in the absence of the project (fuel switch projects), e.g. by increasing the share of biomass use as compared to the baseline, by retrofitting an existing plant to use biomass.	
Project Type Electricity and heat generation from biomass (new plants, capacity expansions, energy efficiency improvements, or fuel switch projects)	Cogeneration project generating electricity from sugarcane bagasse with three units
Biomass Type Biomass residues from production processes (not from dedicated plantations). Examples: bagasse, straw, forest residues.	Sugarcane bagasse (residue from juice extraction process for ethanol and sugar production). Eucalyptus wood used only for boiler ignition (annually). Both are renewable biomass, not from dedicated plantations.
Biomass Storage Biomass not stored for more than one year. Cannot be processed chemically or biologically prior to combustion.	The biomass used by the project plant is not stored for more than one year. The biomass used by the project plant is not processed chemically or biologically (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio-or chemical degradation, etc.) prior to combustion.
Fossil Fuel Co-firing Project does not co-fire fossil fuels OR does not exceed 25% fossil fuel co-firing (per UCR Protocol).	No fossil fuels (diesel, coal, natural gas) used. Only sugarcane bagasse and eucalyptus wood (both renewable). Zero fossil fuel co-firing.
Installed Capacity Methodology applicable to large-scale plants (>25 MW for biomass).	The project activity is a power plant that encompasses cogeneration plants, i.e. power plant in which at least one heat engine simultaneously generates both process heat and power. The total installed capacity of project activity is 91 MW which is acceptable as per the applied large-scale methodology.

Grid Connection Project must be connected to national or regional electricity grid for electricity export.	All three units (UTE 01, UTE 02, UTE 03) connected to Brazilian national electricity grid. Generation data obtained via CCEE (Electric Energy Trading Chamber). ANEEL authorization for commercial operation confirmed.
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C.3 Applicability of double counting emission reductions >>

The project is not registered in any other GHG mechanism. Hence, there will not be any double counting possibility.

The biomass-based boiler and turbine have unique serial numbers which are visible on the units. The generated electricity is measured using energy meters who also has unique serial numbers. The Monitoring Report will have the details of the same and will be provided to the UCR verifier during the verification process.

Usina Bioenergética Aroeira is not certified for i-RECs generation.

Usina Bioenergética Aroeira is also certified by Renovabio, which is the Brazilian National Biofuels Program, created to encourage the production and use of sustainable biofuels, such as ethanol and biodiesel, replacing gasoline and diesel, which are more polluting fossil fuels. The lower the carbon intensity of the biofuel, the greater the difference in relation to fossil fuels, resulting in certificates called CBIOs, which can be traded. The impact of exported energy on the number of CBIOs is very small compared to other factors such as agricultural and industrial efficiency, and it's not the focus of Renovabio certification. Exported energy is just one of many factors considered.

Although RenovaBio and the carbon credit certification system have similar objectives with regard to decarbonization, they are different programs and work in different ways, with their own regulations and mechanisms. However, to adopt a conservative position and avoid double counting, the percentage of Carbon Credits will be deducted here in this program, in the same proportion in which the exported energy boosted the generation of CBIOs, in the respective periods in which they were generated:

Aroeira (UTE 01+UTE 02): May, 2020 to December, 2025: resulting in a reduction of: **2,489 CoUs.**

UTE 3 Triângulo does not have Renovabio certification because it does not produce ethanol, therefore the discount does not apply to it.

C.4. Project boundary, sources and greenhouse gases (GHGs)>>

The project boundary includes the physical, geographical site(s) of:

- All plants generation power located at the project site.

- All power plants connected physically to the electricity system (grid) that the projects plant is connected to.
- All the biomass transported for this project comes from the ethanol and sugar production activity itself and does not come from other locations. The storage is also on-site, resulting in zero emissions.

C.5. Establishment and description of baseline scenario (UCR Protocol) >>

The baseline scenario identified at the PCN stage of the project activity is:

Renewable energy technology that displaces technology using fossil fuels, wherein the simplified baseline is the fuel consumption of the technology that would have been used in the absence of the project activity, times an emission factor for the fossil fuel displaced.

The baseline emissions due to displacement of electricity are determined by net quantity of electricity generation as a result of the project activity (incremental to baseline generation) during the year y in MWh times the CO₂ emission factor for the electricity displaced due to the project activity during the year y in tCO₂/MWh.

Given that power generation for internal consumption is part of the present project activity, emission reductions are only claimed from on-site incremental power generation that is injected to the grid. Therefore, the baseline scenario is the emission of GHG from the present electricity generation mix of the electricity grid.

Leakage Emissions (LE_y):

Leakage emissions are not applicable as the project activity does not use technology or equipment transferred from another activity.

No shift of biomass from other uses: Sugarcane bagasse is a residue generated internally by the sugar/ethanol production process. It was not previously used for any alternative purpose (e.g., animal feed, soil amendment, or energy generation elsewhere) that would be displaced by the project activity. Therefore, no leakage from biomass diversion occurs.

No change in carbon stocks: In the absence of the project, the bagasse would be left to decompose aerobically, releasing biogenic CO₂ and CH₄. The project's controlled combustion in high-efficiency boilers avoids CH₄ emissions from decomposition, resulting in a positive environmental effect — not a leakage source.

No equipment transfer: All equipment (boilers, turbines, generators) is new and dedicated to this project. No equipment was transferred from another activity that would continue operating with increased emissions elsewhere.

No land-use change: The bagasse originates from existing sugarcane plantations. No expansion of cultivated area was required for the project.

No external biomass procurement: The project consumes bagasse generated on-site. No external biomass is purchased that could displace other users or create market-mediated leakage.

Biomass residue utilization: The ashes from bagasse combustion are returned to the sugarcane plantation as fertilizer. This closed-loop process confirms that: no waste disposal or residue accumulation generates emissions elsewhere and nutrients are recycled back to existing sugarcane fields, maintaining soil carbon stocks and supporting the argument that no land-use change or expansion was required for the project.

Hence $LE_y = 0$

Project Emissions (PE_y):

In accordance with ACM0006 (Version 16, Section 5.6), project emissions are explicitly accounted for as follows:

$$PE_y = PE_{(FF,y)} + PE_{(Biomass,y)} + PE_{(GR1,y)} + PE_{(GR2,y)} + PE_{(CBR,y)} + PE_{(BG2,y)} + PE_{(Transport,y)}$$

Where,

- $PE_{(FF,y)}$ = Fossil Fuel Co-firing. CO₂ emissions from fossil fuels (diesel, coal, natural gas) co-fired with biomass in the boilers. If no fossil fuels are used, this is zero.

Only sugarcane bagasse is used, with an annual application of eucalyptus wood (renewable biomass) for boiler ignition. No diesel or any other fossil fuels are used. Therefore,

$$PE_{(FF,y)} = 0$$

- $PE_{(Biomass,y)}$ = Biomass Combustion (CH₄/N₂O)

Emissions from biomass burning. CO₂ is excluded (biogenic), but CH₄ and N₂O may be included if the baseline considered uncontrolled burning. For bagasse combustion, these are negligible.

Scenario	Source	GHG	Included?	Justification/Explanation
Baseline	Grid Connected Electricity Generation	CO ₂	Yes	Main emission source
		CH ₄	No	Not identified in the baseline methodology
		N ₂ O	No	Not identified in the baseline methodology
Project Activity	Sugarcane Bagasse based co-generation Activity	CO ₂	No	Zero-emissions grid connected electricity generation from renewable energy

		CH ₄	No	Zero-emissions grid connected electricity generation from renewable energy
		N ₂ O	No	Zero-emissions grid connected electricity generation from renewable energy

CH₄ and N₂O emissions from bagasse combustion in controlled, high-efficiency industrial boilers are negligible and not quantified for the following reasons:

Combustion conditions: The project boilers operate at high temperatures with controlled air-to-fuel ratios, achieving over 99% combustion efficiency. This minimizes the formation of CH₄, which results from incomplete combustion.

Emission factors: Per the 2019 IPCC Refinement to the 2006 Guidelines, CH₄ emission factors for biomass combustion in industrial boilers are approximately 0.03 kg CH₄/TJ — one to two orders of magnitude lower than emission factors for uncontrolled or open biomass burning (0.3–3 kg CH₄/TJ). At this level, CH₄ emissions are insignificant relative to the project's total emission reductions.

Fuel nitrogen content: Sugarcane bagasse has very low nitrogen content (0.1–0.4% by mass). N₂O formation during combustion is therefore minimal. The IPCC default emission factor for N₂O from biomass combustion in industrial boilers is approximately 0.004 kg N₂O/TJ, representing a negligible contribution in CO₂-equivalent terms.

ACM0006 consistency: ACM0006 (Version 16, Table 2) notes that CH₄ from biomass combustion may be considered but does not require quantification when baseline emissions do not account for these gases. The project baseline was calculated using the Brazilian grid combined margin emission factor (Tool 07), which is based on CO₂ emissions from fossil fuel-fired power plants and does not include CH₄ or N₂O components.

CH₄ and N₂O emissions from bagasse combustion are negligible and excluded per ACM0006 Table 2, consistent with conservative methodology application and CDM precedent for similar biomass projects, therefore:

$$PE_{(Biomass,y)} = 0$$

- **PE_(GR1,y), PE_(GR2,y)** = Grid Electricity Imports (Operating Margin) and (Build Margin) GHG emissions from electricity imported from the grid for project operation.

The project is self-sufficient, therefore:

$$PE_{(GR1,y)}, PE_{(GR2,y)} = 0$$

- **PE_(CBR,y)** = Controlled Burning of Biomass Residues Emissions from intentional, controlled burning of biomass residues outside the boilers (e.g., open burning).

Since this project does not involve burning bagasse outside of the boilers, therefore:

$$PE_{(CBR,y)} = 0$$

- **PE_(BG2,y)** = Biogas-Related Emissions. Emissions from biogas generation or leakage if a biogas system is present.

Since this project is exclusively made from bagasse, therefore:

$$PE_{(BG2,y)} = 0$$

- **PE_(Transport,y)** = Off-site Biomass Transportation CO₂ emissions from transporting biomass to the project site from external sources.

Since this project all biomass is generated and transported internally within the mill, this is negligible and declared as zero:

$$PE_{(Transport,y)} = 0$$

For the Usina Bioenergética Aroeira S.A. project: all seven components are zero, explicitly declared with justification, not omitted.

$$PE_y = 0$$

The actual emission reduction achieved during the first issuing period shall be submitted as a part of monitoring and verification. For an ex-ante estimation for the period from 2013 to 2024, the following calculation has been submitted:

Emission Reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year y (tCO₂/y)

BE_y = Baseline Emissions in year y (t CO₂/y)

PE_y = Project emissions in year y (tCO₂/y)

LE_y = Leakage emissions in year y (tCO₂/y)

$$\text{Annual Baseline Emission Reduction: } BE_y = EG_{PJ,y} \times EF_{grid,y}$$

BE_y = Baseline emissions in year y (t CO₂)

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)

EF_{grid,y} = Combined margin CO₂ 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” (t CO₂/MWh)

As determined by “Tool to calculate the emission factor for an electricity system – Version 7.0” for Brazil ([am-tool-07-v7.0](#)), the combined margin should be calculated using the “Weighted average CM”, as it follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times wOM + EF_{grid,BM,y} \times wBM \quad \text{Equation (16)}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (t CO₂/MWh)

$EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (t CO₂/MWh)

wOM = Weighting of operating margin emissions factor (per cent)

wBM = Weighting of build margin emissions factor (per cent)

Since the project is a biomass co-generation project:

$$wOM = 0.5$$

$$wBM = 0.5$$

Since the project is a biomass co-generation project:

$$PE_y = 0$$

$$LE_y = 0$$

So as result $ER_y = BE_y$

For the Build and Operation margin emission factor, was considered the public data for the years from 2013 to 2024 available in the Ministry of Science, Technology and Innovation website: (<https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao>).

EMISSION FACTOR OF THE MONITORING PERIOD - EF _{grid,CM}						
Month	2014	2015	2016	2017	2018	2019
	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh
January	0.455900	0.425300	0.376700	0.272350	0.351100	0.228000
February	0.447600	0.416850	0.380650	0.258800	0.346450	0.329650
March	0.433100	0.416000	0.393100	0.294750	0.356000	0.304750
April	0.436750	0.400900	0.393600	0.296650	0.321400	0.305750
May	0.428400	0.401100	0.396850	0.305700	0.341550	0.290700
June	0.432050	0.416900	0.397450	0.293700	0.403050	0.259750
July	0.431850	0.411950	0.393450	0.304000	0.367950	0.346700
August	0.441250	0.404900	0.396250	0.306500	0.365900	0.316600
September	0.447850	0.393050	0.399150	0.304400	0.354400	0.331300
October	0.443200	0.399350	0.388050	0.301250	0.357600	0.319500
November	0.442400	0.403300	0.389900	0.302350	0.251200	0.337000
December	0.439400	0.400150	0.380150	0.305300	0.239650	0.350850

EMISSION FACTOR OF THE MONITORING PERIOD - EF _{grid.CM}						
Month	2020	2021	2022	2023	2024	2025
	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh	tCO ₂ eq/MWh
January	0.330300	0.327047	0.274800	0.169218	0.234330	0.153830
February	0.311850	0.328147	0.257638	0.142219	0.213642	0.159430
March	0.241100	0.309847	0.216516	0.171215	0.165105	0.142830
April	0.197150	0.303097	0.121441	0.193484	0.123467	0.180280
May	0.227700	0.322447	0.153626	0.170904	0.167863	0.189880
June	0.286850	0.323997	0.233720	0.284879	0.208541	0.262980
July	0.245550	0.318197	0.222800	0.270277	0.301296	0.300180
August	0.248650	0.337697	0.241800	0.232837	0.326885	0.311980
September	0.213300	0.344547	0.258218	0.195022	0.328852	0.296280
October	0.335100	0.338797	0.246976	0.216998	0.349990	0.304830
November	0.319000	0.343568	0.215184	0.267454	0.302327	0.324530
December	0.354250	0.317738	0.160342	0.236986	0.275043	0.274130

AROEIRA (UTE 01 + UTE 02):

The official power generation data of the UTE 01 - Bioenergética Aroeira and UTE 02 - Energética Tupaciguara (CET) during the Monitoring Period, was informed by CCEE (Electric Energy Trading Chamber) digitally through their website/system:

ELECTRICITY GENERATED IN THE MONITORING PERIOD

ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG						
Month	2014	2015	2016	2017	2018	2019
	MWh	MWh	MWh	MWh	MWh	MWh
January	0	0	2.848	0	1.806	0
February	0	0	0	0	0	0
March	0	943	310	17	2.514	985
April	0	3.033	3.568	2.897	3.504	3.099
May	0	0	3.772	973	3.379	3.423
June	0	0	3.490	102	2.888	3.169
July	0	0	3.945	31	3.398	3.070
August	0	3.783	3.939	493	3.212	2.983
September	2.984	3.406	3.759	353	2.995	2.445
October	2.866	3.761	3.761	866	3.094	2.680
November	2.751	3.536	3.850	3.543	2.912	3.326
December	1.736	3.937	2.320	3.880	648	2.292
Total	10.337	22.398	35.561	13.154	30.350	27.472

ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG						
Month	2020	2021	2022	2023	2024	2025
	MWh	MWh	MWh	MWh	MWh	MWh
January	0	0	0	0	0	0
February	0	0	0	0	0	200
March	1.215	4.407	646	5.218	3.250	11.495
April	3.331	16.142	14.441	12.020	10.813	9.846
May	9.486	19.581	17.468	17.107	13.017	12.564
June	18.884	18.179	16.828	14.333	11.676	12.304
July	19.357	18.514	16.904	15.470	11.710	13.525
August	20.169	18.321	16.003	14.620	12.170	15.247
September	18.618	19.339	16.591	15.720	12.912	14.357
October	19.837	21.252	18.679	15.851	12.224	14.628
November	18.262	6.246	17.123	14.703	12.438	2.738
December	8.141	0	15.015	3.965	6.267	0
Total	137.300	141.981	149.698	129.008	106.478	106.903

The impact of exported energy on the amount of CBIOS:

		may/2020 to apr/2021	may/2021 to april/2024		may/2024 to apr/2027	
		Hydrated	Anhydrous	Hydrated	Anhydrous	Hydrated
CBIOS	NEEA with exported eletricity	67,00	64,92	63,99	70,79	70,47
	NEEA without exported eletricity	66,20	64,18	63,25	69,42	69,11
	Increase	1,208%	1,153%	1,170%	1,973%	1,968%
	Average	1,208%	1,161%		1,971%	
	Factor	0,98792	0,98839		0,98029	

Exported Eletricity less proportion of CBIOS:

ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG						
Month	2020	2021	2022	2023	2024	2025
	MWh	MWh	MWh	MWh	MWh	MWh
January	0	0	0	0	0	0
February	0	0	0	0	0	196
March	1.215	4.353	639	5.158	3.212	11.268
April	3.331	15.947	14.273	11.880	10.687	9.652
May	9.372	19.354	17.265	16.908	12.761	12.316
June	18.656	17.968	16.633	14.166	11.446	12.061
July	19.124	18.299	16.707	15.291	11.479	13.259
August	19.925	18.108	15.817	14.451	11.930	14.946
September	18.393	19.114	16.398	15.537	12.657	14.074
October	19.597	21.005	18.463	15.667	11.983	14.340
November	18.042	6.173	16.924	14.532	12.193	2.684
December	8.043	0	14.841	3.919	6.144	0
Total	135.696	140.322	147.960	127.510	104.493	104.797

Since $ER_y = BE_y = EG \times EF_{grid}$, it is achieved the following results for the emissions reductions ER_y :

EMISSION REDUCTION - ER_y						
Month	2014	2015	2016	2017	2018	2019
	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq
January	0	0	1.073	0	634	0
February	0	0	0	0	0	0
March	0	392	122	5	895	300
April	0	1.216	1.404	859	1.126	947
May	0	0	1.497	297	1.154	995
June	0	0	1.387	30	1.164	823
July	0	0	1.552	9	1.250	1.064
August	0	1.532	1.561	151	1.175	945
September	1.336	1.339	1.500	107	1.062	810
October	1.270	1.502	1.459	261	1.107	856
November	1.217	1.426	1.501	1.071	731	1.121
December	763	1.575	882	1.185	155	804
Total	4.586	8.982	13.939	3.976	10.454	8.666

EMISSION REDUCTION - ER_y						
Month	2020	2021	2022	2023	2024	2025
	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq
January	0	0	0	0	0	0
February	0	0	0	0	0	31
March	293	1.349	138	883	530	1.609
April	657	4.834	1.733	2.299	1.320	1.740
May	2.134	6.241	2.652	2.890	2.142	2.339
June	5.351	5.821	3.887	4.036	2.387	3.172
July	4.696	5.823	3.722	4.133	3.459	3.980
August	4.954	6.115	3.825	3.365	3.900	4.663
September	3.923	6.586	4.234	3.030	4.162	4.170
October	6.567	7.116	4.560	3.400	4.194	4.371
November	5.755	2.121	3.642	3.887	3.686	871
December	2.849	0	2.380	929	1.690	0
Total	37.180	46.006	30.774	28.850	27.470	26.946

For the current monitoring period no biomass residue was collected from outside, thus for this monitoring period, the value of this parameter is zero (PE_y), however, using the UCR principles of conservativeness in emission reductions quantification, prevention of over-generation of credits and based on stakeholder comments on project emissions, transport emissions are calculated by applying a net-to-gross adjustment of 10%, i.e. multiply the emission reductions determined based on the applied methodology by 0.9 to determine the final amount of emission reductions.

	2014	2015	2016	2017	2018	2019
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
Total	4.127	8.083	12.544	3.578	9.408	7.799

	2020	2021	2022	2023	2024	2025
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
Total	33.461	41.405	27.696	25.964	24.722	24.251

Total amount of emission reductions was 223,038 tCO2eq for the monitoring period, **already considering the deduction the proportion of CBIOS.**

Total emission reductions (Aroeira): $ER_y = 223,038 \text{ tCO}_2 / \text{year}$ (223,038 CoUs /year)

TRIÂNGULO (UTE 03):

The official power generation data of the UTE 03 – Triângulo Energia during the Monitoring Period, was informed by CCEE (Electric Energy Trading Chamber) digitally through their website/system:

ELECTRICITY GENERATED IN THE MONITORING PERIOD

ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG		
Month	2024	2025
	MWh	MWh
January		0
February		0
March		14.294
April		12.488
May		16.501
June	17.629	16.518

July	19.171	18.151
August	19.180	17.309
September	14.137	14.908
October	9.440	10.120
November	6.934	0
December	4.490	0
Total	105.890	120.289

UTE 3, Triângulo does not have Renovabio certification because it does not produce ethanol, therefore the discount of CBIOS does not apply to it.

Since $ER_y = BE_y = EG \times EF_{grid}$, it is achieved the following results for the emissions reductions ER_y :

EMISSION REDUCTION - ER_y		
Month	2014	2015
	tCO ₂ eq	tCO ₂ eq
January		0
February		0
March		2,042
April		2,251
May		3,133
June	3,676	4,344
July	5,776	5,448
August	6,270	5,400
September	4,649	4,417
October	3,304	3,085
November	2,096	0
December	1,235	0
Total	27,006	30,120

For the current monitoring period no biomass residue was collected from outside, thus for this monitoring period, the value of this parameter is zero (PE_y), however, using the UCR principles of conservativeness in emission reductions quantification, prevention of over-generation of credits and based on stakeholder comments on project emissions, transport emissions are calculated by applying a net-to-gross adjustment of 10%, i.e. multiply the emission reductions determined based on the applied methodology by 0.9 to determine the final amount of emission reductions.

	2024	2025
	tCO ₂ eq	tCO ₂ eq
Total	24,305	27,108

Total amount of emission reductions was 51,413 tCO₂eq for the monitoring period, **already considering the deduction the proportion of CBIOS.**

Total emission reductions (Aroeira): $ER_y = 51,413 \text{ tCO}_2 / \text{year} (51,413 \text{ CoUs /year})$

TOTAL – BIOENERGÉTICA AROEIRA (UTE 01 + UTE 02 + UTE 03):

The official power generation data of the UTE 01 - Bioenergética Aroeira, UTE 02 - Energética Tupaciguara (CET) and UTE 03 – Triângulo Energia during the Monitoring Period, was informed by CCEE (Electric Energy Trading Chamber) digitally through their website/system:

Exported Electricity less proportion of CBIOS:

ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG						
Month	2014 MWh	2015 MWh	2016 MWh	2017 MWh	2018 MWh	2019 MWh
January	0	0	2.848	0	1.806	0
February	0	0	0	0	0	0
March	0	943	310	17	2.514	985
April	0	3.033	3.568	2.897	3.504	3.099
May	0	0	3.772	973	3.379	3.423
June	0	0	3.490	102	2.888	3.169
July	0	0	3.945	31	3.398	3.070
August	0	3.783	3.939	493	3.212	2.983
September	2.984	3.406	3.759	353	2.995	2.445
October	2.866	3.761	3.761	866	3.094	2.680
November	2.751	3.536	3.850	3.543	2.912	3.326
December	1.736	3.937	2.320	3.880	648	2.292
Total	10.337	22.398	35.561	13.154	30.350	27.472

ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG						
Month	2020 MWh	2021 MWh	2022 MWh	2023 MWh	2024 MWh	2025 MWh
January	0	0	0	0	0	0
February	0	0	0	0	0	196

March	1.215	4.353	639	5.158	3.212	25,562
April	3.331	15.947	14.273	11.880	10,687	22,140
May	9.372	19.354	17.265	16.908	12,761	28,817
June	18.656	17.968	16.633	14.166	29,075	28,579
July	19.124	18.299	16.707	15.291	30,650	31,409
August	19.925	18.108	15.817	14.451	31,110	32,255
September	18.393	19.114	16.398	15.537	26,794	28,982
October	19.597	21.005	18.463	15.667	21,423	24,459
November	18.042	6.173	16.924	14.532	19,128	2,684
December	8.043	0	14.841	3.919	10,634	0
Total	135.696	140.322	147.960	127.510	195,474	225,085

Since $ERY = BEy = EG \times EF_{grid}$, it is achieved the following results for the emissions reductions ERY:

EMISSION REDUCTION - ERY						
Month	2014	2015	2016	2017	2018	2019
	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq
January	0	0	1.073	0	634	0
February	0	0	0	0	0	0
March	0	392	122	5	895	300
April	0	1.216	1.404	859	1.126	947
May	0	0	1.497	297	1.154	995
June	0	0	1.387	30	1.164	823
July	0	0	1.552	9	1.250	1.064
August	0	1.532	1.561	151	1.175	945
September	1.336	1.339	1.500	107	1.062	810
October	1.270	1.502	1.459	261	1.107	856
November	1.217	1.426	1.501	1.071	731	1.121
December	763	1.575	882	1.185	155	804
Total	4.586	8.982	13.939	3.976	10.454	8.666

EMISSION REDUCTION - ERY						
Month	2020	2021	2022	2023	2024	2025
	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq
January	0	0	0	0	0	0
February	0	0	0	0	0	31
March	293	1.349	138	883	530	3,651
April	657	4.834	1.733	2.299	1,320	3,991
May	2.134	6.241	2.652	2.890	2,142	5,472
June	5.351	5.821	3.887	4.036	6,063	7,516

July	4.696	5.823	3.722	4.133	9,235	9,429
August	4.954	6.115	3.825	3.365	10,169	10,063
September	3.923	6.586	4.234	3.030	8,811	8,587
October	6.567	7.116	4.560	3.400	7,498	7,456
November	5.755	2.121	3.642	3.887	5,783	871
December	2.849	0	2.380	929	2,925	0
Total	37.180	46.006	30.774	28.850	54,476	57,067

For the current monitoring period no biomass residue was collected from outside, thus for this monitoring period, the value of this parameter is zero (*PEy*), however, using the UCR principles of conservativeness in emission reductions quantification, prevention of over-generation of credits and based on stakeholder comments on project emissions, transport emissions are calculated by applying a net-to-gross adjustment of 10%, i.e. multiply the emission reductions determined based on the applied methodology by 0.9 to determine the final amount of emission reductions.

	2014	2015	2016	2017	2018	2019
	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq
Total	4.127	8.083	12.544	3.578	9.408	7.799

	2020	2021	2022	2023	2024	2025
	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq	tCO ₂ eq
Total	33.461	41.405	27.696	25.964	49,028	51,359

Total amount of emission reductions was 274,452 tCO₂eq for the monitoring period, **already considering the deduction the proportion of CBIOS.**

Total emission reductions (Aroeira): $ER_y = 274,452 \text{ tCO}_2 / \text{year}$ (274,452 CoUs /year)

C.6. Prior History>>

The project activity has not applied to any other GHG program for generation or issuance of carbon offsets or credits for the said crediting period.

Usina Bioenergética Aroeira S.A. is not certified for i-RECs generation.

Usina Bioenergética Aroeira S.A. is also certified by Renovabio. which is Brazilian National Biofuels Program. created to encourage the production and use of sustainable biofuels. such as ethanol and biodiesel. replacing gasoline and diesel. which are more polluting fossil fuels. It certifies companies based on the environmental efficiency of production. allowing them to issue CBIOS (Decarbonization Credits). which can be sold. Although RenovaBio and the carbon credit certification system have

similar objectives when it comes to decarbonization. they are different programs and work in different ways. with their own regulations and mechanisms.

The CBIO is a financial instrument generated **exclusively** by the production of **biofuels**. in this case, **ethanol**. On the other hand, the carbon credits proposed in this project are generated by surplus **renewable energy exported** to the electricity grid.

- Law No. 13.576/2017 (RenovaBio Law. https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2017/lei/l13576.htm): Establishes the National Biofuels Policy. **focusing on the production and use of biofuels**. without mentioning the generation of carbon credits for surplus energy.

- ANP Resolution No. 758/2018 (<https://atosoficiais.com.br/anp/resolucao-n-758-2018-regulamenta-a-certificacao-da-producao-ou-importacao-eficiente-de-biocombustiveis-de-que-trata-o-art-18-da-lei-no-13-576-de-26-de-dezembro-de-2017-e-o-credenciamento-de-firmas-inspetoras?origin=instituicao&q=Resolu%C3%A7%C3%A3o%20ANP%20n%C2%BA%20758/2018>): Regulates the certification of efficient production of biofuels. treating electrical energy as a co-product. **but not as a direct source of CBIOs**.

- Technical Note nº 62/2018/SBQ/ANP: Details the methodology for calculating CBIOs. reaffirming that exported electrical energy is considered only as a co-product.

In the Renovabio program, the RenovaCalc tool is used, which uses exported energy as one of the factors to calculate the plant's Energy-Environmental Efficiency Rating (NEEA). that is an indicator of the efficiency of the production process. specifically in the industrial phase. A higher NEEA indicates a more efficient process, which generally results in a lower carbon intensity. Impact on CBIOs: the amount of CBIOs generated is based on the difference between the carbon intensity of the biofuel and that of the equivalent fossil fuel. The lower the carbon intensity of the biofuel, the greater the difference compared to fossil fuel, resulting in more CBIOs generated.

Role of Exported Energy in generating CBIOs:

Exported electrical energy is considered a beneficial co-product. It "credits" the process, effectively reducing the carbon intensity attributed to the biofuel. This is because exported renewable energy replaces potentially more carbon-intensive energy on the grid.

If a plant exports more renewable energy, its NEEA tends to improve. A better NEEA generally results in a lower carbon intensity for the ethanol produced. With lower carbon intensity, the gap with fossil fuel increases. Consequently, more CBIOs are generated per unit of biofuel produced.

Whereas the impact of exported energy on the amount of CBIOs is generally marginal compared to other factors such as agricultural and industrial efficiency, exported energy is just one of the many factors considered in the NEEA calculation. However, to adopt a conservative position and avoid double counting, percentage of Carbon Credits will be deducted here in this program, in the same proportion in which the exported energy boosted the generation of CBIOs, in the respective periods in which they were generated:

$$NEEA = \left(\frac{EF_{fossil} - EF_{bio}}{EF_{fossil}} \right) \times 100$$

Where:

- EF_{fossil} = **Emission Factor of the reference fossil fuel** (gCO₂eq/MJ)
- EF_{bio} = **Emission Factor of the assessed biofuel** (gCO₂eq/MJ)

The EF_{bio} is obtained by considering all emissions from the biofuel's life cycle. including:

- Biomass production
- Transportation
- Industrial processing
- Distribution

Since the NEEA formula depends on the difference between EF_{fossil} and EF_{bio} . any reduction in EF_{bio} (through fossil fuel replacement or clean energy exports) boosts the efficiency score and allows for the issuance of more CBIOs per liter of ethanol.

The number of CBIOs (Decarbonization Credits) generated by a biofuel producer is calculated using the following formula:

$$CBIOs = \frac{V_{bio} \times LCV \times NEEA \times D}{10^3}$$

Where:

- V_{bio} = **Volume of biofuel** produced and sold (in cubic meters. m³)
- **LCV** = **Lower Calorific Value** of the biofuel (MJ/L)
- **NEEA** = **Energy-Environmental Efficiency Score** (%)
- **D** = **Density** of the biofuel (kg/L)

So, we can conclude that NEEA is directly proportional to the generation of CBIOs. Since exported energy is one of the factors that improves the NEEA score. to be conservative. we will calculate how much the exported energy contributes to the increase in the NEEA score. Then. we will deduct this percentage from the Carbon Credits that will be generated here in this program. during the same period in which CBIOs were generated. for the issuance of carbon credits.

NEEA with exported electricity	X
NEEA without exported electricity	Y
Increase (%)	$\frac{(X - Y)}{Y}$
Adjustment Factor	$1 - \frac{(X - Y)}{Y}$

The table shows the calculation of the adjustment factor to account for the impact of exported electricity on the NEEA score and, consequently, on CBIOS.

- **NEEA with exported electricity (X)** → Efficiency score considering exported electricity.
- **NEEA without exported electricity (Y)** → Efficiency score without considering exported electricity.

- **Increase (%)** → The impact of exported electricity on NEEA is given by:

$$\frac{(X - Y)}{Y}$$

This represents **how much the exported electricity increased the NEEA score**.

Adjustment Factor → To adjust the exported electricity for carbon credit generation without double counting with CBIOS, we apply the factor:

$$1 - \frac{(X - Y)}{Y}$$

This factor can be used to **discount the fraction of Carbon Credits**, regarding exported energy that has already contributed to increasing NEEA, and respectively the CBIOS.

This percentage calculation will be applied in the specific period of issuance of the CBIO and credit year.

C.7. Monitoring period number and duration>>

First Monitoring Period: 11 years and 4 months – Sep 01. 2014 to Dec 31. 2025

C.8. Changes to start date of crediting period >>

There is no change in the start date of crediting period.

C.9. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

There are no permanent changes from registered PCN monitoring plan and applied methodology.

C.10. Monitoring plan>>

All energy generation data is acquired through CCEE meters installed in Usina Bioenergética Aroeira substation.

Meter	Serial Number	Specification
1	MW-1809A999-02 (Main) UTE 01 – Bioenergética Aroeira	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1.8 Wh-varh/pulse Year of manufacturer: 2018 Last Calibration: february 10.2026 Installation Code: MGUBIAUBAR101P
2	MW-1810A175-02 (Check) UTE 01 – Bioenergética Aroeira	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1.8 Wh-varh/pulse Year of manufacturer: 2018 Last Calibration: february 10.2026 Installation Code: MGUBIAUBAR101R

3	MW-1810A171-02 (Main) UTE 02 – Central Energética Tupaciguara	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1.8 Wh-varh/pulse Year of manufacturer: 2018 Last Calibration: february 10.2026 Installation Code: MGUBIAUBAR202P
4	MW-1810A137-02 (Check) UTE 02 – Central Energética Tupaciguara	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1.8 Wh-varh/pulse Year of manufacturer: 2018 Last Calibration: february 10.2026 Installation Code: MGUBIAUBAR202R
5	MW-2305A342-02 (Main) UTE 03 – Triângulo Energia	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1.8 Wh-varh/pulse Year of manufacturer: 2023 Last Calibration: june 17.2023 Installation Code: MGUBIAUTRIA03P
6	MW-2305A492-02 (Check) UTE 03 – Triângulo Energia	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1.8 Wh-varh/pulse Year of manufacturer: 2023 Last Calibration: june 17.2023 Installation Code: MGUBIAUTRIA03R



Meter 1 (UTE 01 – Bioenergética Aroeira - Main)



Meter 2 (UTE 01 – Bioenergética Aroeira - Check)



Meter 3 (UTE 2 – Central Energética Tupaciguara - Main)



Meter 4 (UTE 2 – Central Energética Tupaciguara - Check)



Meter 5 (UTE 3 – Triângulo Energia - Main) Meter 6 (UTE 3 – Triângulo Energia Check)

The meters are locked and can be manipulated only under CCEE or ONS authorization. All generation data is available digitally and can be checked by the Usina Bioenergética Aroeira personnel through CCEE system at CCEE website.

Parameters being monitored or used in emission reductions determination:

Data and parameters available at validation (ex-post values):

Data / Parameter:	EG _{pj.y}
Data unit:	MWh
Description:	Quantity of net electricity generation and export supplied by the project plant/unit to the grid in year y
Source of data:	The data provided by the Câmara de Comercialização de Energia Elétrica – CCEE (Electric Energy Trading Chamber)
Measurement procedures (if any):	This parameter is monitored using bidirectional energy meter
Monitoring frequency:	Continuous monitoring, hourly measurement and at least monthly recording
QA/QC procedures:	The meters and current transformers will be subjected to periodic calibrations/audits from ANEEL and CCEE to certify that electric energy injected in the grid data is reliable and precise, in a way to guarantee the reliability of the national grid and energy supply. As determined by government entity ONS (National Electric System Operator), in the "Submodule 6.16 - Maintenance of the billing measurement system" item 1.1.2, the calibration of the meters must occur every 5 years.

Data and parameters available at validation (ex-ante values):

Data/Parameter	EF _{grid.y}
Data unit	tCO ₂ e/MWh
Description	CO ₂ emission factor of the grid electricity in year y
Source of data Value(s) applied	https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao
Measurement methods and procedures	As per the requirements in “Tool to calculate the emission factor for an electricity system”
Monitoring frequency	Monthly
Purpose of data	To estimate baseline emissions

Emission Factor

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2014	0.2963											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2014	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.6155	0.5989	0.5699	0.5772	0.5605	0.5678	0.5674	0.5862	0.5994	0.5901	0.5885	0.5825

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2015	0.2553											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2015	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.5953	0.5784	0.5767	0.5465	0.5469	0.5785	0.5686	0.5545	0.5308	0.5434	0.5513	0.5450

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2016	0.1581											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2016	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.5953	0.6032	0.6281	0.6291	0.6356	0.6368	0.6288	0.6344	0.6402	0.6180	0.6217	0.6022

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2017	0.0028											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2017	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.5419	0.5148	0.5867	0.5905	0.6086	0.5846	0.6052	0.6102	0.6060	0.5997	0.6019	0.6078

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2018	0.1370											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2018	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.5652	0.5559	0.5750	0.5058	0.5461	0.6691	0.5989	0.5948	0.5718	0.5782	0.3654	0.3423

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2019	0.1020											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2019	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.3540	0.5573	0.5075	0.5095	0.4794	0.4175	0.5914	0.5312	0.5606	0.5370	0.5720	0.5997

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2020	0.0979											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2020	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.5627	0.5258	0.3843	0.2964	0.3575	0.4758	0.3932	0.3994	0.3287	0.5723	0.5401	0.6106

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2021	0.0540											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2021	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.6001	0.6023	0.5657	0.5522	0.5909	0.5940	0.5824	0.6214	0.6351	0.6236	0.6331	0.5815

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2022	0.0270											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2022	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.5226	0.4883	0.4060	0.2159	0.2803	0.4404	0.0419	0.4566	0.4894	0.4670	0.4034	0.2937

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL												
2023	0.0467											
OPERATION MARGIN												
Average Emission Factor (tCO ₂ /MWh) - MONTHLY												
2023	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.2917	0.2377	0.2957	0.3403	0.2951	0.5231	0.4939	0.4190	0.3433	0.3873	0.4882	0.4273

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL													
2024	0.0523												
OPERATION MARGIN													
Average Emission Factor (tCO ₂ /MWh) - MONTHLY													
2024	MONTH												
	January	February	March	April	May	June	July	August	September	October	November	December	
	0.4164	0.3750	0.2779	0.1946	0.2834	0.3648	0.5503	0.6015	0.6054	0.6477	0.5524	0.4978	

CONSTRUCTION MARGIN

Average Emission Factor (tCO ₂ /MWh) - ANNUAL													
2025	0.0711												
OPERATION MARGIN													
Average Emission Factor (tCO ₂ /MWh) - MONTHLY													
2025	MONTH												
	January	February	March	April	May	June	July	August	September	October	November	December	
	0.2366	0.2478	0.2146	0.2895	0.3087	0.4549	0.5293	0.5529	0.5215	0.5386	0.5780	0.4772	