Universal Carbon Registry

Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT

Title: 105 MW Sugarcane Bagasse based co-generation Energy USINA CERRADÃO

Version 1.0

Date January 5, 2026

First CoU Issuance Period: 12 years

Date: Jan 01, 2013 to Dec 31, 2024

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

Monitoring Report

Title of the project activity	105 MW Sugarcane Bagasse based co-generation Energy USINA CERRADÃO
UCR Project Registration Number	584
Version	Version 1
Completion date of the MR	January 5, 2026
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 1 Duration of this monitoring Period: (first and last days included (01/01/2013 to 31/12/2024)
Project participants	CERRADÃO (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	2013: 15,981 CoUs (15,981 tCO2eq)
	2014: 8,761 CoUs (8,761 tCO2eq)
	2015: 37,951 CoUs (37,951 tCO2eq)
	2016: 41,745 CoUs (41,745 tCO2eq)
	2017: 44,929 CoUs (44,929 tCO2eq)
	2018: 53,988 CoUs (53,988 tCO2eq)
	2019: 81,504 CoUs (81,504 tCO2eq)
	2020: 85,608 CoUs (85,608 tCO2eq)
	2021: 84,918 CoUs (84,918 tCO2eq)
	2022: 45,612 CoUs (45,612 tCO2eq)
	2023: 67,996 CoUs (67,996 tCO2eq)
	2024: 87,821 CoUs (87,821 tCO2eq)
Total:	**656,814 CoUs (656,814 tCO2eq)**

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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 "105 MW Sugarcane Bagasse based co-generation Energy USINA CERRADÃO" is composed of a sugar cane plant, located in the city of Frutal in the state of Minas Gerais, Brazil.

The project originated with the authorization granted to **Usina Cerradão** to establish itself as an Independent Power Producer through the development and operation of the thermoelectric power plant named **"UTE 1 – Cerradão I"** (Authorizing Resolution No. 1,401, dated June 10, 2008). The project included a **25 MW generator**, with the substation operating at 13,800 Volts.

In 2013, the capacity was expanded with the installation of an additional **30 MW generator** and a new substation, this time operating at 138 kV (Authorizing Resolution No. 4,031, dated April 9, 2013). The 25 MW and 30 MW generators were connected in parallel.

In 2018, Usina Cerradão was authorized to operate as an Independent Power Producer through the development and operation of a second thermoelectric power plant named **UTE 2 - Biocerradão II** (Ordinance No. 363, dated August 23, 2018). The project included a **40 MW generator**, with the substation operating at 138 kV.

In 2020, Usina Cerradão was authorized to operate as an Independent Power Producer through the development and operation of the thermoelectric power plant named **Cerradão 3**, with the installation of a new **60 MW generator** (Ordinance No. 286, dated July 14, 2020).

Subsequently, in 2022, the name of **UTE Cerradão 3** was changed to **UTE 3 - Boa Esperança.**

Unit	Installed Capacity	Location	Commercial Operation Date
UTE 1 - Cerradão I	55 MW (25 MW+ 30 MW)	Frutal, Minas Gerais	December 22, 2009 (Dispatch nº 4,752 - ANEEL)
UTE 2 - Biocerradão II	40 MW	Frutal, Minas Gerais	May 16, 2020 (Dispatch nº 1,370 – ANEEL)
UTE 3 - Boa Esperança	60 MW	Frutal, Minas Gerais	September 23, 2022 (Dispatch nº 2,709) – ANEEL)

UTE 1 - Cerradão I: Operating/Environmental License - LO Nº 017/2020
UTE 2 – Biocerradão II: Operating/Environmental License - LO Nº 091/2020
UTE 3 - Boa Esperança: Operating/Environmental License - LO Nº: 3829/2021

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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.

Cerradão Mill was established on June 1, 2006. Based on a modular project, the Industrial Unit was initially designed to process up to 2,400,000 tons of sugarcane in its first phase. The effective operation of Grupo Cerradão began in the 2009/2010 harvest year, with the crushing of 785,627 tons of sugarcane.

They have experienced steady growth in their crushing capacity each year, increasing from 786 thousand tons in the 2009/2010 harvest to 5,576,780 tons in the 2023/2024 harvest, with expectations exceeding 6,500,000 tons in the 2024/2025 harvest year.

In 2024, approximately 685,000 MWh were exported, an amount sufficient to supply around 356,000 households, equivalent to approximately 1.07 million people.

Frutal Plant:

Usina Cerradão operates across multiple business segments, including the production of high-quality sugar and ethanol from sugarcane, the generation of renewable energy through biomass power plants, the manufacture of yeast for industrial and food applications, and the cultivation and commercialization of grains, all with a focus on sustainability and efficiency.

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

1. Implementation Status of the Project Activity

The USINA CERRADÃO project is a 105 MW sugarcane bagasse-based cogeneration energy system composed of:

UTE 1 - Cerradão I, UG-1: 25 MW and UG-2: 30 MW, operational since December 22, 2009.
UTE 2 - Biocerradão II, UG-3: 40 MW, operational since May 16, 2020.
UTE 3 - Boa Esperança, UG-4: 60 MW, operational since September 23, 2022.

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 (Sermatec):
Nº 01 (Engevap): 200 TPH (tons per hour), 65 kgf/cm², 490°C.
Nº 02 (Engevap): 250 TPH (tons per hour), 66 kgf/cm², 490°C.
Nº 03 (Caldema): 330 TPH (tons per hour), 67 kgf/cm², 525°C.

Turbines:
Nº 01 (TGM Turbinas): 29,002 kW, 65 bar, 480°C.
Nº 02 (TGM Turbinas): 27,994 kW, 65 bar, 520°C.
Nº 03 (Siemens): 40,050 kW, 64,5 bar, 480°C.
Nº 04 (TGM Turbinas): 61,969 kW, 64.25 bar, 520°C.

Alternators (WEG):
Nº 01 (WEG): 31,250 kW, PF: 0.8, 13,800 V, 60 Hz.
Nº 02 (WEG): 37,500 kW, PF: 0.8, 13,800 V, 60 Hz.
Nº 03 (WEG): 51,000 kW, PF: 0.8, 13,800 V, 60 Hz.
Nº 04 (WEG): 66,667 kW, PF: 0.9, 13,800 V, 60 Hz.

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

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

The Usina Cerradão 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 - Cerradão I	January 21, 2020 / April 27, 2026	December 22, 2009
UTE 2 - Biocerradão II	July 17, 2020 / April 27, 2026	May 16, 2020
UTE 3 - Boa Esperança	August 18, 2021 / Abril 13, 2029	September 23, 2022

UCR Project ID: UCR ID Number: 584
Start Date of Crediting Period: Jan 01, 2013.
End Date of Crediting Period: Dec 31, 2024.
Monitoring Period: Jan 01, 2013 to Dec 31, 2024.

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	Jan 01, 2013
Carbon credits claimed up to	Dec 31, 2024
Total ERs generated (tCO_{2eq})	656,814 tCO2eq
Leakage	0

e) Baseline Scenario>>

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

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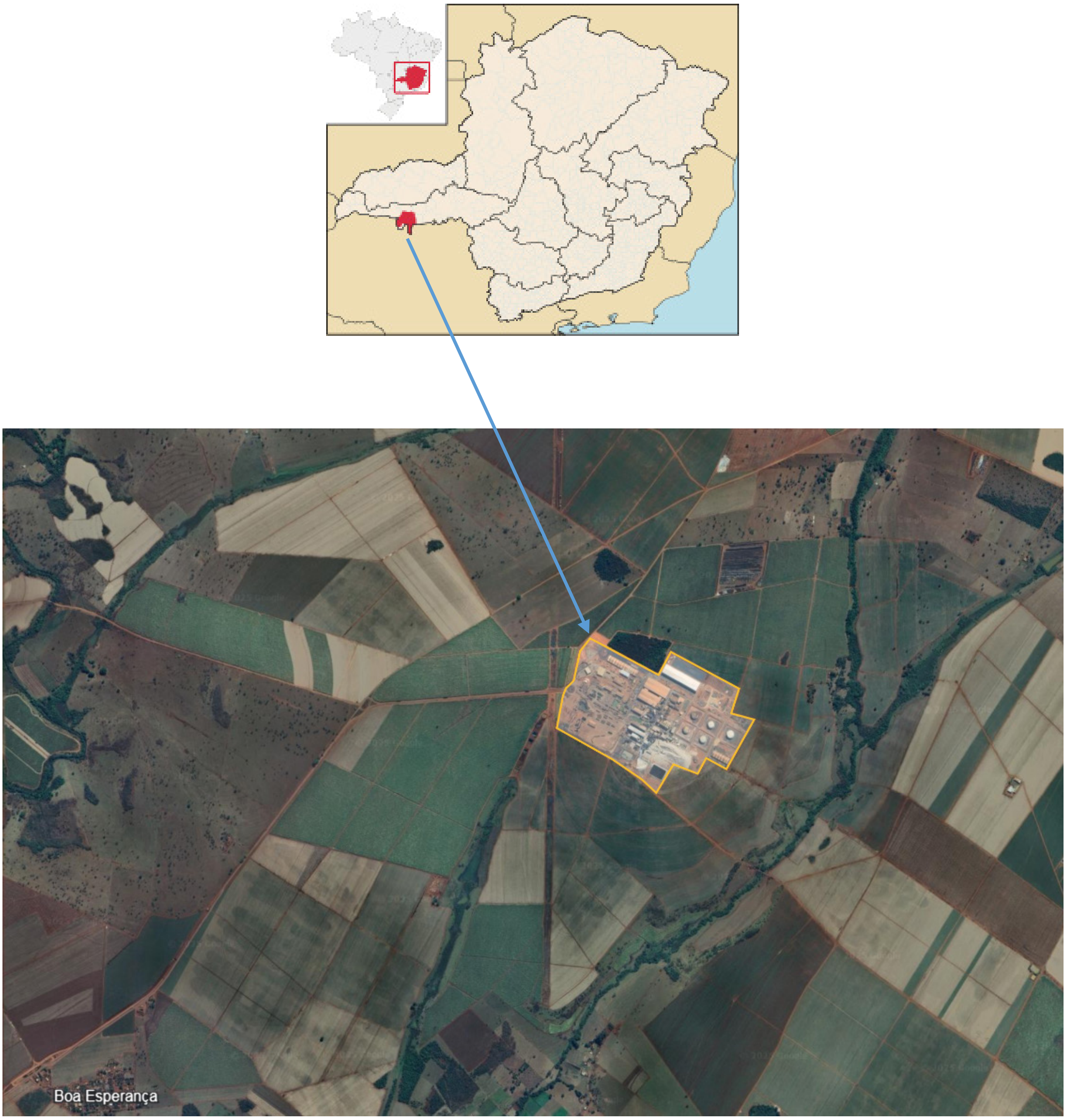
A.2. Location of project activity>>

Country: Brazil
District: Frutal
State: Minas Gerais
Zip Code: 38200-000
Latitude: -19.9183º
Longitude: -49.1458º



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A.3. Parties and project participants >>

Party (Host)	Participants
Brazil	**Owner:** USINA CERRADÃO Rodovia MG 255, km 30 - s/n - Zona Rural, Frutal - MG, Zip Code: 38200-000 https://www.cerradao.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: II - 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 (≤25%) as per UCR protocol.

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

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The total installed capacity of 105 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: 12 years – Jan 01, 2013-Dec 31, 2024

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>>

The materialization of the enterprise began with the establishment of Cerradão on June 1, 2006. Based on a modular project, the Industrial Unit was designed in its first phase for a milling capacity of up to 2,400,000 tons of sugarcane. Cerradão's effective operation began in the 2009/10 cycle, with the milling of 785,627 tons of raw material.
The authorization for grid power injection from the National Electrical Energy Agency (ANEEL) for the first Generator Unit in December 22, 2009 for UG01, with 25MW and modifies the installed capacity to 55MW in April 9, 2013.
Subsequently, it obtained authorization for the Cerradão II Power Plant to start commercial operation on May 16, 2020, with its generating unit of 40,000 kW.
Finally, on September 23, 2022, it obtained the authorization for the generating unit UG1, of 60,000.00 kW, of the UTE Boa Esperança

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

- AUTHORIZING RESOLUTION No. 1,401, OF JUNE 10, 2008:
Authorizes Usina Cerradão to establish itself as an Independent Power Producer, for the generating unit TG1, of 25,000 kW

- DISPATCH No. 4,752, OF DECEMBER 21, 2009:
Authorization for the generating unit TG1, of 25,000 kW, of the UTE Cerradão, for the start of commercial operation.

- AUTHORIZING RESOLUTION No. 4,031, OF APRIL 9, 2013:
Modifies the installed capacity of the Thermoelectric Power Plant to 55 MW.
of 25,000 kW

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- ORDINANCE No. 363, OF AUGUST 23, 2018:
Authorization for Usina Cerradão to establish itself as an Independent Power Producer through the implementation and operation of the thermoelectric power plant named Cerradão II, 40,000 kW.

- DISPATCH No. 1,370, OF MAY 15, 2020:
Authorization for the generating unit UTE Cerradão II, of 40,000 kW, for the start of commercial operation.

- ORDINANCE No. 286, OF JULY 14, 2020: Authorization to establish itself as an Independent Power Producer, through the implementation and operation of the Thermoelectric Generating Plant named Cerradão III.

- DISPATCH No. 2,709, OF SEPTEMBER 22, 2022:
Authorization for the generating unit UG1, of 60,000.00 kW, of the UTE Boa Esperança (Former Cerradão III), for the start of commercial operation.

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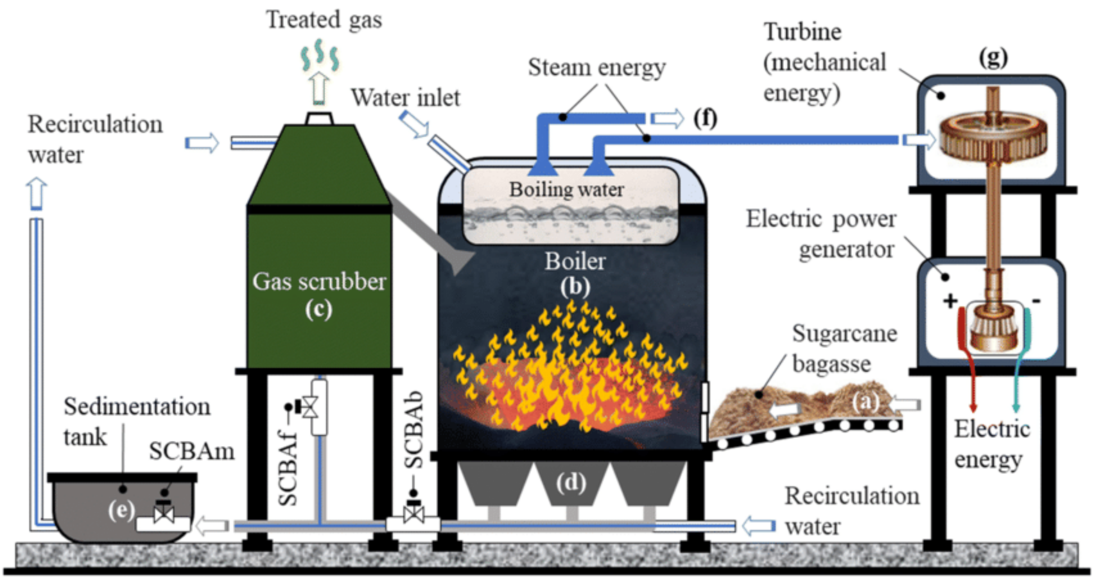
b) For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate>>

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



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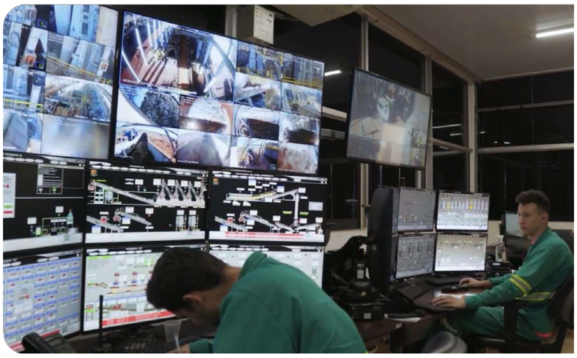
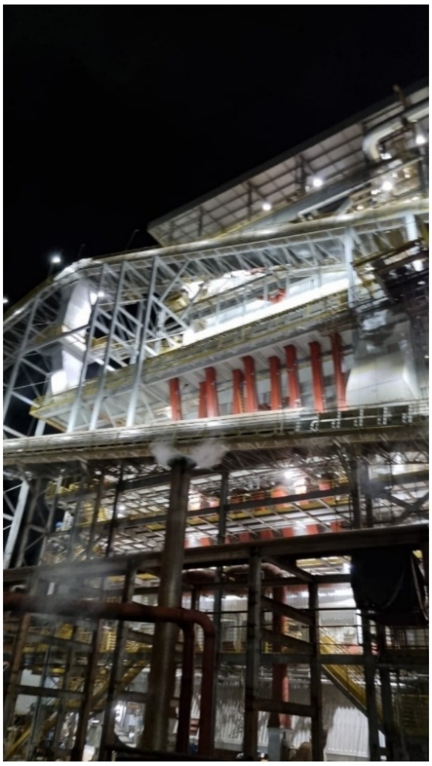
Frutal Plant:





Boilers

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Automation Systems

Electrical Systems

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Generator nº 1

Generator nº 2

Generator nº 3

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Generator nº 4

The system consists of four power-generating units supplied by three boilers. Boilers nº. 1 and nº. 2 supply Generators 1, 2, and 3, while Boiler nº 3 supplies Generator 4.

Boiler	Nº 01	Nº 02	Nº 03
Manufacturer	ENGEVAP	ENGEVAP	CALDEMA
Capacity (Tons/h)	200	250	330
Serial number	048/08	073/11	175/2021
Year of manufacturer	2008	2017	2021
Maximum allowable working pressure (kgf/cm^2g)	75	76	80
Hydrostatic Test Pressure (kgf/cm^2g)	112.5	114	120
Pressure (kgf/cm^2)	65	66	67
Degree of super heat °C (Steam)	490	490	525
Heating surface area (m^2)	5.650	6,060	8,108
Design Standard	ASME I -2004	ASME I -2010	ASME I -2019
category	A	A	A

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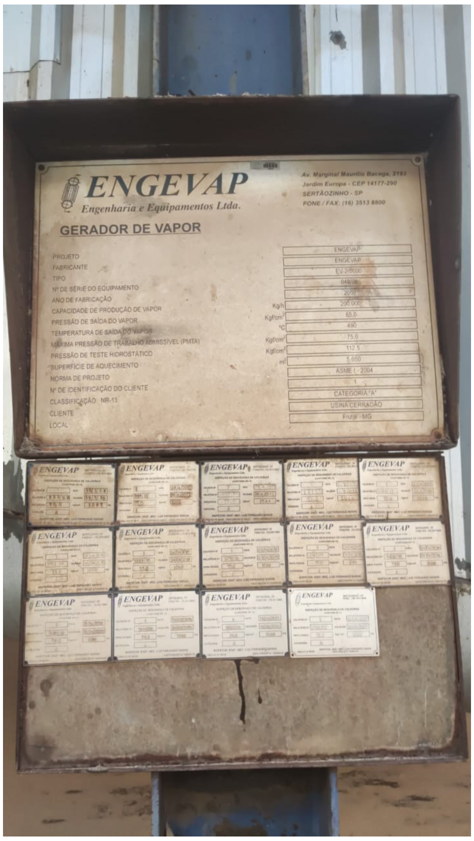
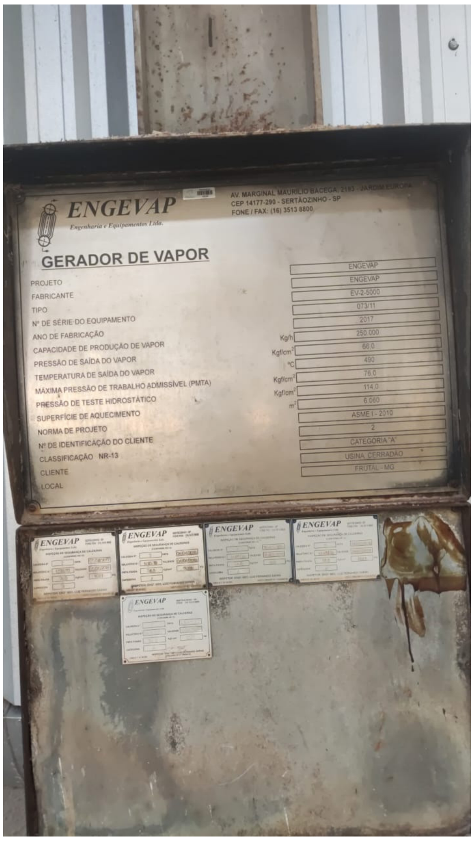
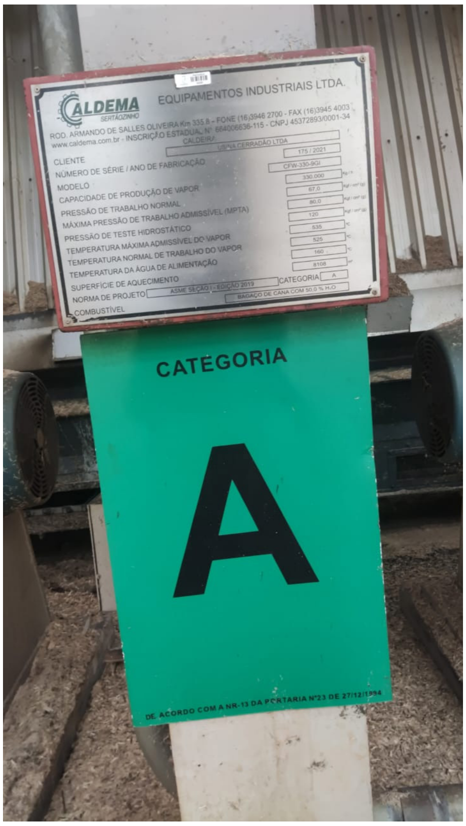


Boiler nº 1



Boiler nº 2



Boiler nº 3

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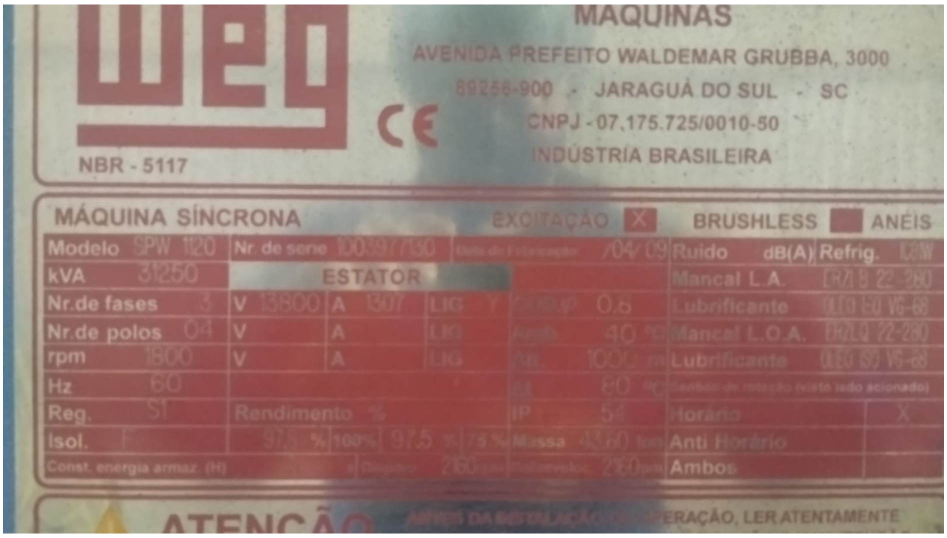
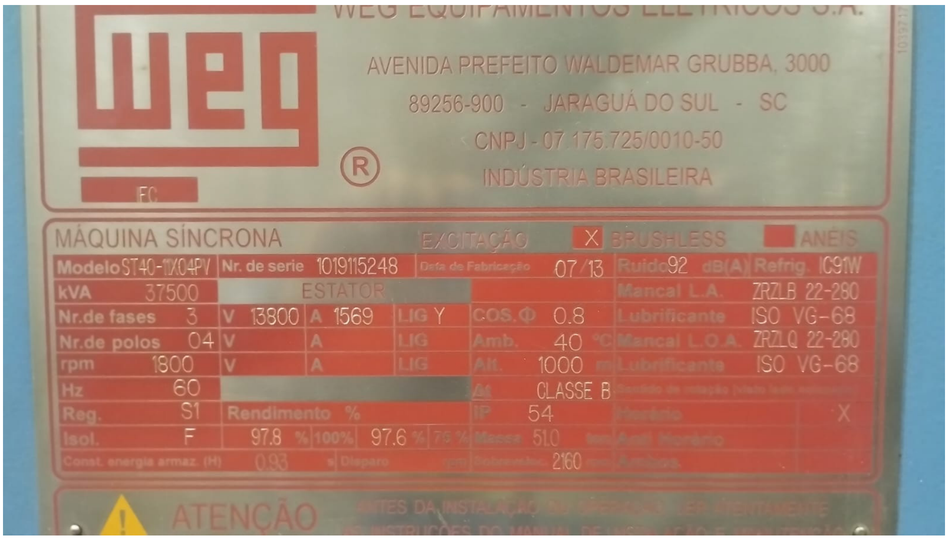
Alternator/ Generator	**№ 1**	**№ 2**	**№ 3**	**№ 4**
Year of manufacturer	April, 2009	July, 2013	June, 2018	December, 2021
Manufacturer	WEG	WEG	WEG	WEG
Power Rated (kVA)	31,250	37,500	51,000	66,667
Serial Number	1003977130	1010184150	1042402479	1061885790
Voltage (V)	13,800	13,800	13,800	13,800
Current (Amps)	1,307	1,569	2,134	2,789
Power Factor (cos φ)	0.80	0.80	0.80	0.90
Efficiency (75%, 100% of load)	97.5%, 97.8%	97.6%, 97.8%	97.5%, 97.6%	98.1%, 98.2%
Generator Rated Speed (rpm)	1,800	1,800	1,800	1,800
Frequency (Hz)	60	60	60	60
Generator Model	SPW 1120	ST40-11X04PV	ST40-1120	ST41-1120



Alternator/ Generator nº 1



Alternator/ Generator nº 2

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Alternator/ Generator nº 3

Alternator/ Generator nº 4

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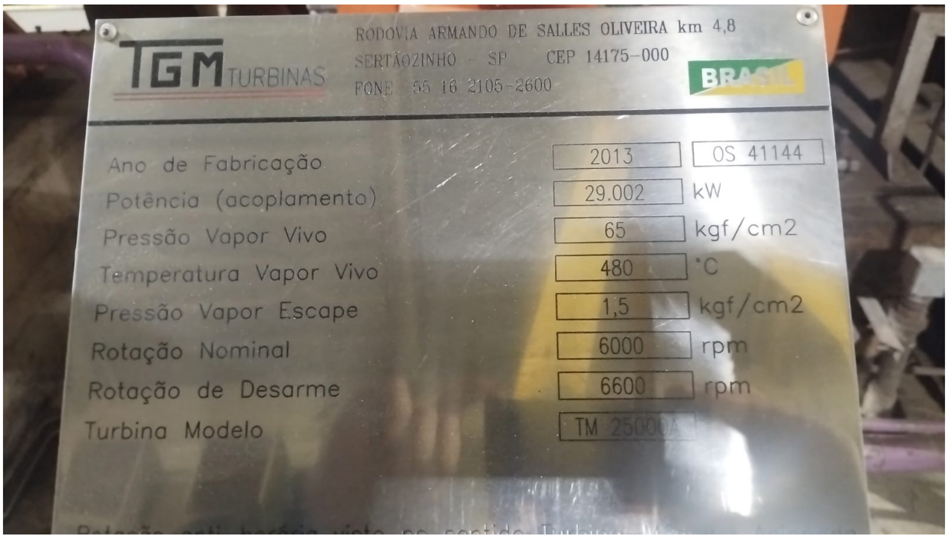
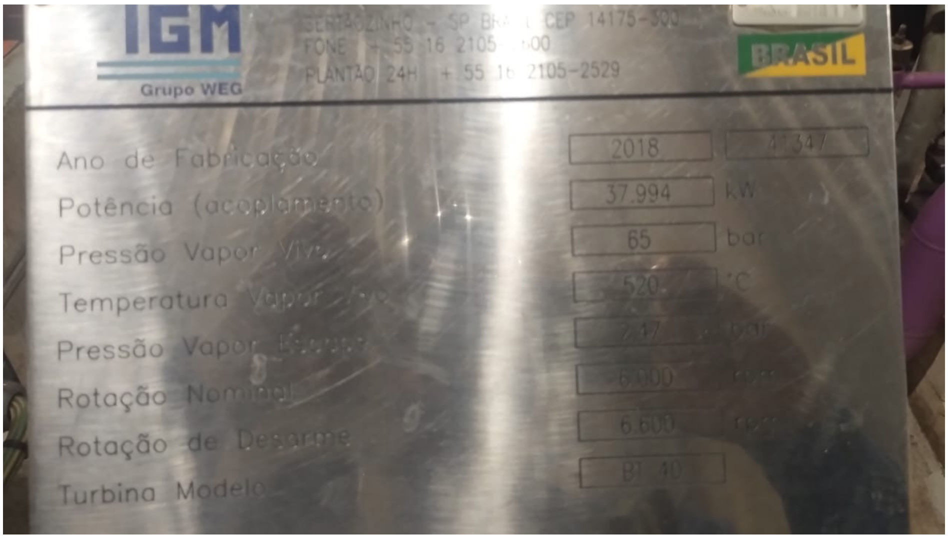
Turbine	Nº 1	Nº 2	Nº 3	Nº 4
Year of manufacturer	2013	2018	2018	2021
Manufacturer	TGM Turbinas	TGM Turbinas	Siemens	TGM Turbinas
Power Rated (kW)	29,002	27,994	40,050	61,969
Live Steam Pressure (Bar)	65	65	64,5	64.25
Live Steam Temperature (ºC)	480	520	480	520
Steam Exhaust Pressure (Bar)	1.5	2.47	2.5	2.67
Turbine Rated Speed (rpm)	6,000	6,000	7,059	4,300
Turbine Disarm Speed (rpm)	6,600	6,600	7,765	4,730
Turbine Model	TM 25000 A	BT-40	SST-300	BT63



Turbine nº 1



Turbine nº 2

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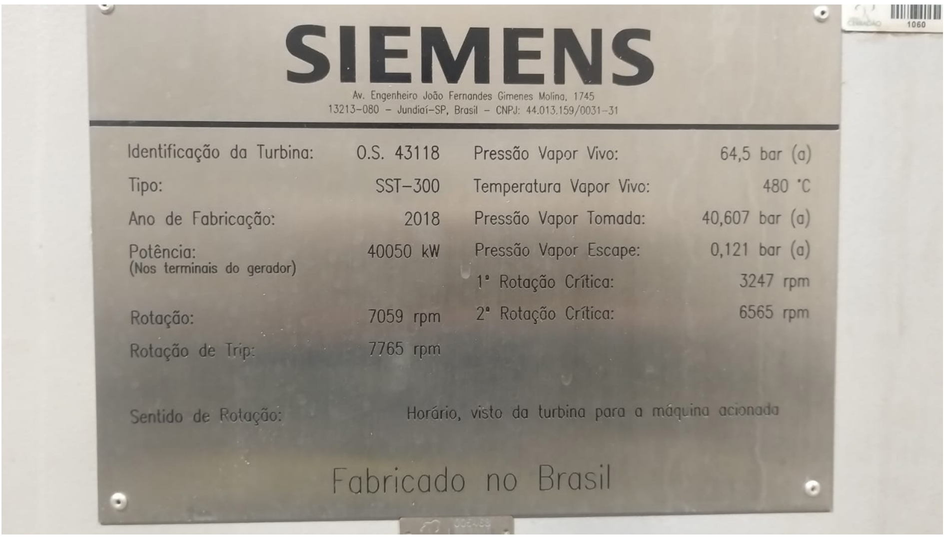
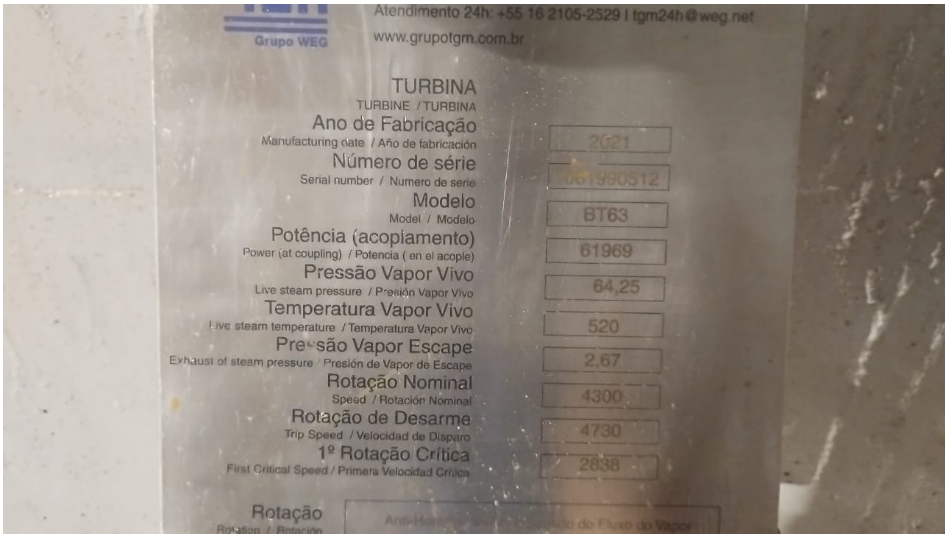


Turbine nº 3



Turbine nº 4

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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 municipalities of Frutal and surrounding regions.
- Training and professional qualification programs, such as the Leadership Track and partnerships with Fundação Dom Cabral, which strengthen local workforce skills.
- Health and safety initiatives, including occupational health programs, medical outpatient services, and prevention campaigns (PAS – Safe Attitude Program, Befit).
- Improvement of local quality of life through community projects such as the Nascentes do Cerrado, benefiting rural communities and farmers.
- Contributes to the construction of cattle guards, helping to protect natural habitats and facilitate sustainable livestock management.

- **Environmental benefits:**
- Avoids global and local environmental pollution, leading to reduction of GHG emissions.
- Recovery of degraded areas and springs through the *Nascentes do Cerrado Project* (over 23,000 seedlings planted, 25 springs under recovery, long-term goal of 170,000 native trees).
- Efficient water management, with **97% reuse of process water**, fertigation with vinasse, and monitoring of water availability in rivers.
- Circular economy practices, with reuse of by-products (filter cake, ash, vinasse), and safe return of agrochemical packaging to InpEV.
- Usina Cerradão produces anhydrous ethanol and hydrated ethanol derived from sugar cane. Since these products is all plant-based, their biofuel is renewable and sustainable. In addition to the socio-economic benefits, ethanol is less harmful to the environment than fossil fuels, such a gasoline. That is why carbon emissions are lower, both in the manufacturing process and in final. use.

- **Economic benefits:**
- Greater supply of cheap energy, ensuring the development of the region.
- Significant contribution to regional development through investments of around USD 85 million) in modernization and infrastructure.
- Generation of value across the supply chain, including local suppliers, transporters, and service providers.
- Tax contributions at municipal and state levels, strengthening public services in health, education, and infrastructure.
- Diversification of revenue streams through bioelectricity generation, biofuels, and carbon credit potential, reinforcing business resilience and regional economic sustainability.

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Usina Cerradão contributes significantly to economic, environmental and social matters, however, it stands out as it contributed to 17 SDG's.

SDG	Target	How was it achieved?
1 NO POVERTY	1.1 - By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.90 a day	Job creation (>1,500 employees) and economic contribution to local communities through taxes, local hiring, and partnerships.
2 ZERO HUNGER	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	Adoption of sustainable agricultural practices, crop rotation, fertigation, and integrated pest management; program for spring and preservation area recovery.
3 GOOD HEALTH AND WELL-BEING	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	Occupational health programs, safety and health policies, training and wellness initiatives; medical clinics and occupational safety actions.
4 QUALITY EDUCATION	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	Training programs (Leadership Track, technical training, mentoring with Fundação Dom Cabral), >450 training sessions delivered.
5 GENDER EQUALITY	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	Commitments and internal policies promoting diversity, DE&I, programs to prevent gender-based violence and to foster leadership training.The "Life and Career" Project, focused on women from local communities, providing support and development for their personal and professional growth.

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6 CLEAN WATER AND SANITATION	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 withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	Water management with recycling and reuse, monitoring of water availability, use of vinasse for fertigation; spring recovery projects (Nascentes do Cerrado Project).
7 AFFORDABLE AND CLEAN ENERGY	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix.	Clean Energy Generation
8 DECENT WORK AND ECONOMIC GROWTH	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 1,500 direct and indirect jobs, PAS (Safe Attitude Program) and Befit initiatives, occupational health and safety policies, HR and training.
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE	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	Investments in modernization (USD 85 million in upgrades and improvements), installed cogeneration capacity (165 MWh), use of COI and COA.
10 REDUCED INEQUALITIES	10.2 - By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	Signature of the UN Women's Empowerment Principles and inclusion programs for local communities and suppliers.

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11 SUSTAINABLE CITIES AND COMMUNITIES	11.a - Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	'Internet for All' project with installation of 4G antenna ensuring connectivity for neighboring municipalities.
12 RESPONSIBLE CONSUMPTION AND PRODUCTION	12.2 - By 2030, achieve the sustainable management and efficient use of natural resources 12.5 - By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	Circular economy: reuse of >99% of residues, waste sorting center, return of pesticide packaging to InpEV, and composting of by-products (filter cake, ash).
13 CLIMATE ACTION	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.	RenovaBio and ISCC certification; issuance of CBIOs; investments in energy efficiency and GHG reduction.
14 LIFE BELOW WATER	14.1 - By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution 14.2 - By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	Improves water quality monitoring and availability in river basins that ultimately connect to the Atlantic Ocean. Monitoring of ichthyofauna (aquatic fauna).
15 LIFE ON LAND	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. 15.2 - By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.	Annual production of approximately 30,000 seedlings of various native species, which are used in reforestation projects for riparian forests and native vegetation areas, in partnership with environmental authorities, as well as for donations to the community. Preservation areas, fauna monitoring, and seedling planting for restoration.
16 PEACE, JUSTICE AND STRONG INSTITUTIONS	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.

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17 PARTNERSHIPS FOR THE GOALS	17.17 - Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	Partnerships with IEF, Fundação Dom Cabral, Copersucar and others for restoration, training, and commercialization projects.

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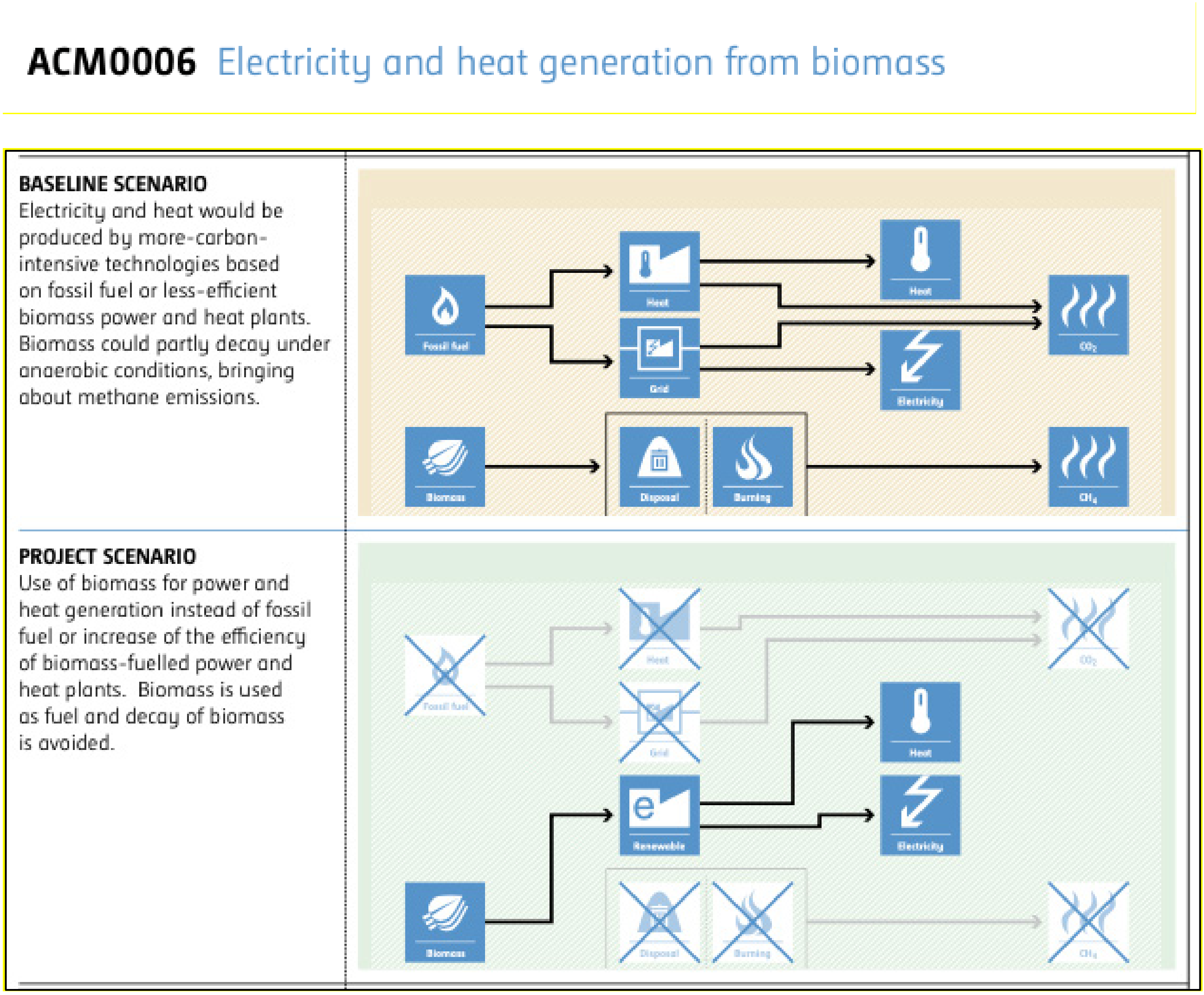
B.3. Baseline Emissions>>

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.



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 2013-2024 accumulated as a result of carbon credits generated will help repay the investments and help in the continued maintenance of this project activity.

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B.4. Debundling>>

This “105 MW Sugarcane Bagasse based co-generation Energy USINA CERRADÃO” 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.

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.
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 105 MW which is acceptable as per the applied large scale methodology.
The installation of a new biomass residue fired power generation unit, which are places existing power generation capacity fired with fossil fuel as in the project plant (power capacity expansion projects) is also included in this methodology.
For the purposes of this methodology, heat does not include waste heat, i.e. heat that is transferred to the environment without utilization, for example, heating flue gas, heat transferred to cooling towers or any other heat losses.

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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.
The Project Activity uses biomass residues from a production process (e.g. production of sugar and ethanol), and the implementation of the project does not result in an increase of the processing capacity of (the industrial facility generating the residues) raw input (e.g. sugar and ethanol) or in other substantial changes (e.g. product change) in this process.
The project activity unit does not co-fire fossil fuel and/or does not exceed the limit of 25% co-firing fossil fuel criteria as per the UCR Protocol for such projects.
Bio-mass generated power is used for direct grid supply and for meeting the captive need facility. The project activity is involving the grid-connected bagasse based electricity generation capacity involving the installation of facilities for all owing the export of electricity to the regional grid.
Bio-mass is not sourced from dedicated plantations. The existing installed turbo-generators are fired by bagasse, a by-product of the sugarcane processing and ethanol, a biomass residue
Bagasse is burnt in boilers as generated from the sugar mill and does not require any specific technology for its preparation before combustion. No fuel preparation equipment has been installed at site for preparation of bagasse. Hence no significant energy quantities are required to prepare the biomass residues for fuel combustion.
The project activity also does not include any GHG emissions related to the decomposition or burning of biomass. The baseline heat emissions for the project activity are not included in the project boundary nor does it claim for emission reductions from heat.

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 Cerradão is not certified for i-RECs generation.

Usina Cerradão 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.

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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:

Usina Cerradão: May, 2020 to December, 2024: resulting in a reduction of 20,979 CoUs.

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.
- The means of transportation of biomass to the project site if the feedstock is biomass residues, the site where the biomass residues would have been left for or dumped.

Leakage Emissions (LE_y)

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

Hence $LE_y = 0$

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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_2O	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_2O	No	Zero-emissions grid connected electricity generation from renewable energy

Project Emissions (PE_y)
The project emissions (PEy) under the methodology may include;

N_2O Excluded simplification. conservative

This is

- CO_2 emissions from transportation of biomass residue to the project site
- CO_2 emissions from on-site consumption of fossil fuels due to project activity
- CO_2 emissions from electricity consumption at the project site that is attributable to the project activity and
- CH_4 emissions from combustion of biomass.

Where,

PET_y = are the CO_2 emissions during the year y due to transport of the biomass to the project plant in tons of CO_2,

$PEFF_{CO2,y}$ = are the CO_2 emissions during the year y due to fossil fuels co-fired by the generation facility in tons of CO_2,

PEEC,y = are the CO_2 emissions during the year y due to electricity consumption at the project site that is attributable to the project activity in tons of CO2,

GWPCH4 = is the Global Warming Potential for methane valid for the relevant commitment period and,

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$PE_{Biomass,CH4,y}$ = are the CH_4 emissions from the combustion of biomass during the year y. The proposed project activity does not have any CO_2 emissions due to off-site transportation of biomass, or from fossil fuel co-firing and from electricity consumption at site. The project activity also doesn't include CH_4 emissions from the combustion of biomass.

Hence,
$PET_y = 0$, $PEFF_{CO2,y} = 0$, $PEEC_{,y} = 0$ and, $PE_{Biomass,CH4,y} = 0$.

Therefore, $PE_y = 0$.

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 CO_2 emission factor for the electricity displaced due to the project activity during the year y in tCO_2/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.

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:

ERy = BEy – PEy – LEy Where:
ERy = Emission reductions in year y (tCO_2/y)
BEy = Baseline Emissions in year y ($t\ CO_2/y$)
PEy = Project emissions in year y (tCO_2/y)
LEy = Leakage emissions in year y (tCO_2/y)

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

BEy = Baseline emissions in year y ($t\ CO_2$)

$EG_{PJ,y}$ = 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)

$EF_{grid,y}$ = 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" ($t\ CO_2/MWh$)

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

$PEy = 0$
$LEy = 0$

So as result $ERy = BEy$

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 - EFgrid,CM						
Month	2013	2014	2015	2016	2017	2018
	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh
January	0.439600	0.455900	0.425300	0.376700	0.272350	0.351100
February	0.433550	0.447600	0.416850	0.380650	0.258800	0.346450
March	0.430450	0.433100	0.416000	0.393100	0.294750	0.356000
April	0.436150	0.436750	0.400900	0.393600	0.296650	0.321400
May	0.427150	0.428400	0.401100	0.396850	0.305700	0.341550
June	0.439650	0.432050	0.416900	0.397450	0.293700	0.403050
July	0.424500	0.431850	0.411950	0.393450	0.304000	0.367950
August	0.414050	0.441250	0.404900	0.396250	0.306500	0.365900
September	0.431150	0.447850	0.393050	0.399150	0.304400	0.354400
October	0.430200	0.443200	0.399350	0.388050	0.301250	0.357600
November	0.439750	0.442400	0.403300	0.389900	0.302350	0.251200
December	0.440750	0.439400	0.400150	0.380150	0.305300	0.239650

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EMISSION FACTOR OF THE MONITORING PERIOD - EFgrid,CM						
Month	2019	2020	2021	2022	2023	2024
	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh	tCO2eq/MWh
January	0.228000	0.330300	0.327047	0.274800	0.169218	0.234330
February	0.329650	0.311850	0.328147	0.257638	0.142219	0.213642
March	0.304750	0.241100	0.309847	0.216516	0.171215	0.165105
April	0.305750	0.197150	0.303097	0.121441	0.193484	0.123467
May	0.290700	0.227700	0.322447	0.153626	0.170904	0.167863
June	0.259750	0.286850	0.323997	0.233720	0.284879	0.208541
July	0.346700	0.245550	0.318197	0.222800	0.270277	0.301296
August	0.316600	0.248650	0.337697	0.241800	0.232837	0.326885
September	0.331300	0.213300	0.344547	0.258218	0.195022	0.328852
October	0.319500	0.335100	0.338797	0.246976	0.216998	0.349990
November	0.337000	0.319000	0.343568	0.215184	0.267454	0.302327
December	0.350850	0.354250	0.317738	0.160342	0.236986	0.275043

The official power generation data of the UTE 1 - Cerradão I, UTE 2 - Biocerradão II and UTE 3 - Boa Esperança 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	2013	2014	2015	2016	2017	2018
	MWh	MWh	MWh	MWh	MWh	MWh
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	27	0	0
April	1,831	4,657	3,421	12,427	11,716	11,997
May	4,743	5,648	13,643	7,849	13,607	20,367
June	5,505	5,574	15,579	15,009	19,959	22,460
July	5,409	5,196	14,398	14,142	23,750	25,901
August	5,536	1,428	14,447	14,470	24,054	23,852
September	4,675	0	14,687	13,229	24,373	24,038
October	5,002	0	12,629	13,696	24,308	28,244
November	5,014	0	8,876	13,280	23,449	12,917
December	3,520	0	6,629	14,021	0	0
Total	41,235	22,502	104,309	118,152	165,216	169,777

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ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG						
Month	2019	2020	2021	2022	2023	2024
	MWh	MWh	MWh	MWh	MWh	MWh
January	0	23,012	22,962	0	0	0
February	0	19,422	22,135	0	0	0
March	14,377	0	1	0	0	1
April	21,227	20,457	16,317	16,226	10,434	27,241
May	29,808	35,137	41,102	24,725	39,758	48,670
June	30,158	41,830	34,481	25,161	42,479	48,857
July	32,632	41,653	33,435	37,426	45,672	50,623
August	34,893	42,884	46,715	36,980	45,288	49,236
September	33,502	44,757	41,519	39,179	45,732	48,556
October	34,954	43,153	39,275	37,332	46,369	49,268
November	31,046	26,152	2,714	23,071	43,992	31,800
December	23,087	22,824	0	0	26,535	30,954
Total	285,683	361,282	300,655	240,099	346,259	385,208

The impact of exported energy on the amount of CBIOs:

		2020 - 2023		2023-2024	
		Anhydrous	Hydrated	Anhydrous	Hydrated
CBIOs	NEEA with exported eletricity	60,20	60,10	62,50	62,43
	NEEA without exported eletricity	57,50	57,30	58,67	58,59
	Increase	4,696%	4,887%	6,528%	6,554%
	Average	4,791%		6,541%	
	Factor	0,95209		0,93459	

Exported Eletricity less proportion of CBIOs:

ELECTRICITY GENERATED IN THE MONITORING PERIOD - EG					
Month	2020	2021	2022	2023	2024
	MWh	MWh	MWh	MWh	MWh
January	23,012	21,862	0	0	0
February	19,422	21,075	0	0	0
March	0	1	0	0	1
April	20,457	15,535	15,448	9,752	25,459
May	33,454	39,132	23,541	37,158	45,487
June	39,826	32,829	23,955	39,701	45,662
July	39,658	31,833	35,633	42,684	47,312
August	40,829	44,476	35,208	42,326	46,015
September	42,613	39,530	37,302	42,740	45,380
October	41,086	37,393	35,543	43,336	46,046
November	24,899	2,584	21,965	41,114	29,720
December	21,730	0	0	24,799	28,929
Total	346,986	286,250	228,596	323,610	360,011

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Since ERy = BEy = EG x EFgrid, it is achieved the following results for the emissions reductions ERy:

EMISSION REDUCTION - ERy						
Month	2013	2014	2015	2016	2017	2018
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
January	0	0	0	0	0	0
February	0	0	0	0	0	0
March	0	0	0	11	0	0
April	799	2,034	1,372	4,891	3,476	3,856
May	2,026	2,419	5,472	3,115	4,160	6,956
June	2,420	2,408	6,495	5,965	5,862	9,053
July	2,296	2,244	5,931	5,564	7,220	9,530
August	2,292	630	5,850	5,734	7,373	8,727
September	2,016	0	5,773	5,281	7,419	8,519
October	2,152	0	5,043	5,315	7,323	10,100
November	2,205	0	3,580	5,178	7,090	3,245
December	1,551	0	2,653	5,330	0	0
Total	17,757	9,735	42,168	46,384	49,921	59,987

EMISSION REDUCTION - ERy						
Month	2019	2020	2021	2022	2023	2024
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
January	0	7,601	7,150	0	0	0
February	0	6,057	6,916	0	0	0
March	4,381	0	0	0	0	0
April	6,490	4,033	4,709	1,876	1,887	3,143
May	8,665	7,617	12,618	3,616	6,350	7,636
June	7,834	11,424	10,636	5,599	11,310	9,522
July	11,313	9,738	10,129	7,939	11,537	14,255
August	11,047	10,152	15,020	8,513	9,855	15,042
September	11,099	9,089	13,620	9,632	8,335	14,923
October	11,168	13,768	12,669	8,778	9,404	16,116
November	10,463	7,943	888	4,727	10,996	8,985
December	8,100	7,698	0	0	5,877	7,957
Total	90,560	95,120	94,354	50,681	75,551	97,579

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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.

	2013	2014	2015	2016	2017	2018
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
Total	15,981	8,761	37,951	41,745	44,929	53,988

	2019	2020	2021	2022	2023	2024
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
Total	81,504	85,608	84,918	45,612	67,996	87,821

Total amount of emission reductions was 656,814 tCO2eq for the monitoring period, **already considering the deduction the proportion of CBIOs.**

Total emission reductions: *ERy* = 656,814 tCO_2 / year (656,814 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 Cerradão is not certified for i-RECs generation.

Usina Cerradão 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.

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- 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** (gCO_2eq/MJ)
- EF_{bio} = **Emission Factor of the assessed biofuel** (gCO_2eq/MJ)

The $\boldsymbol{EF_{bio}}$ is obtained by considering all emissions from the biofuel’s life cycle, including:

- Biomass production
- Transportation
- Industrial processing
- Distribution

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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:

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

Where:

- V_{bio} = **Volume of biofuel** produced and sold (in cubic meters, m^3)
- **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 eletricity	X
NEEA without exported eletricity	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.

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- **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: 12 years – Jan 01, 2013 to Dec 31, 2024

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.

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C.10. Monitoring plan>>

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

Meter	Serial Number	Specification
1	MW-1801A374-02 (Main) UTE 1 – Cerradão I	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1/5 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2018 Last Calibration: october 28,2025 Installation Code: MGCRRDCERR101P
2	MW-1709A788-02 (Check) UTE 1 – Cerradão I	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1/5 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2017 Last Calibration: october 28,2025 Installation Code: MGCRRDCERR101R
3	MW-1709A775-02 (Main) UTE 2 – Biocerradão II	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1.0 / 5.0 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2017 Last Calibration: october 29,2025 Installation Code: MGCRRDCERR202P
4	MW-1709A795-02 (Check) UTE 2 – Biocerradão II	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1.0 / 5.0 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2017 Last Calibration: october 29,2025 Installation Code: MGCRRDCERR202R

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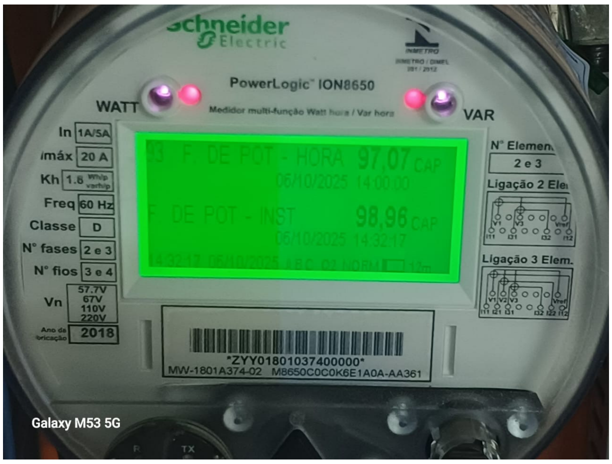
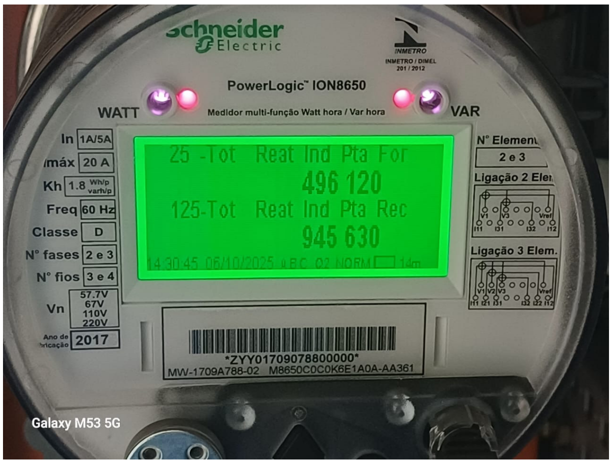
5	MW-2103A679-02 (Main) UTE 3 – Boa Esperança	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1.0 / 5.0 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2021 Last Calibration: october 30,2025 Installation Code: MGCRRDCERR303P
6	MW-2103A565-02 (Check) UTE 3 – Boa Esperança	Schneider Power Logic ION8650 3 Phases 57.7 ~ 220 V 1.0 / 5.0 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2021 Last Calibration: october 30,2025 Installation Code: MGCRRDCERR303R



Meter 1 (UTE 1 - Cerradão I - Main)



Meter 2 (UTE 1 - Cerradão I - Check)

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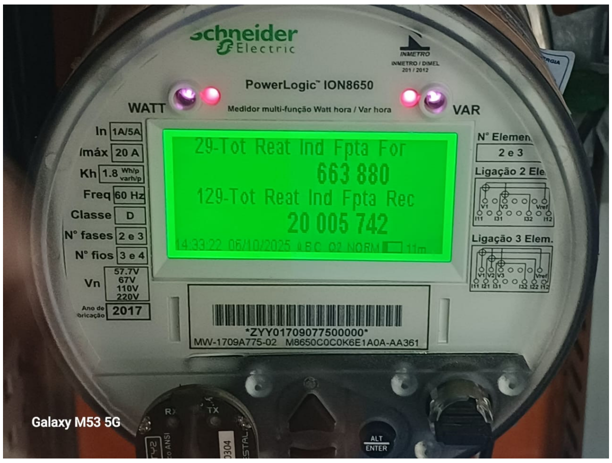
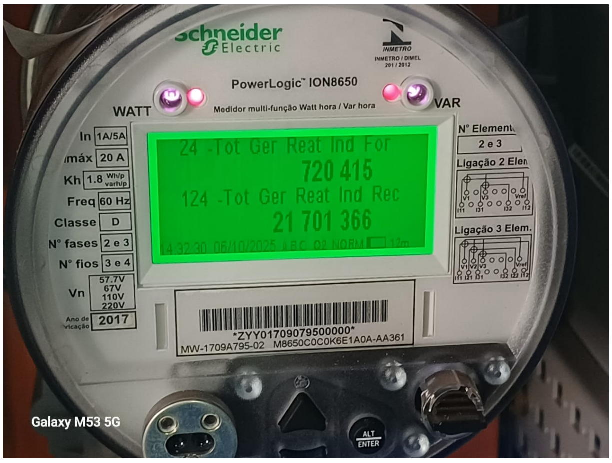
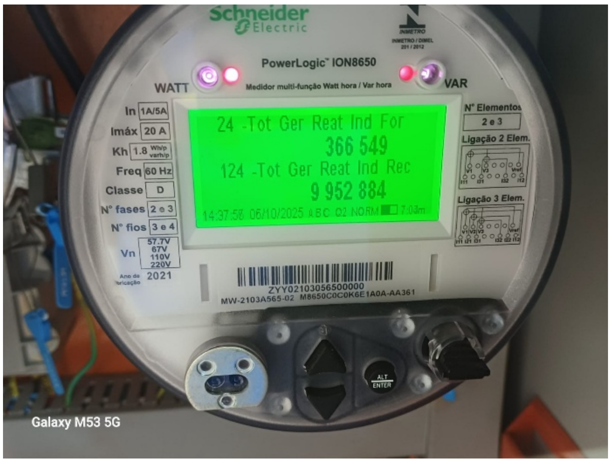


Meter 3 (UTE 2 - Biocerradão II - Main)



Meter 4 (UTE 2 – Biocerradão II - Check)

Meter 5 (UTE 3 Main)



Meter 6 (UTE 3 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 Cerradão personnel through CCEE system at CCEE website.

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Parameters being monitored or used in emission reductions determination:

Data/Parameter	$EF_{grid,y}$
Data unit	tCO_2e/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

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.

ANNEX I – Emission Factor

CONSTRUCTION MARGIN

	Average Emission Factor (tCO_2/MWh) - **ANNUAL**											
2013	0.2713											
OPERATION MARGIN												
	Average Emission Factor (tCO_2/MWh) - **MONTHLY**											
2013	MONTH											
	January	February	March	April	May	June	July	August	September	October	November	December
	0.6079	0.5958	0.5896	0.6010	0.5830	0.6080	0.5777	0.5568	0.5910	0.5891	0.6082	0.6102

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

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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

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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

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