PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT

Title: 90 MW Sugarcane Bagasse based co-generation Energy BEVAP Bioenergia

Version 1.0

Date 27/05/2025

First CoU Issuance Period: 12 years

Date: 01/01/2013 to 31/12/2024

Project Concept Note (PCN)
CARBON OFFSET UNIT (CoU) PROJECT

BASIC INFORMATION	
Title of the project activity	90 MW Sugarcane Bagasse based co-generation Energy BEVAP Bioenergia
Scale of the project activity	Large Scale
Completion date of the PCN	27/05/2025
Project participants	BEVAP BIOENERGIA (OWNER) FASTCARBON (AGGREGATOR)
Host Party	BRAZIL
Applied methodologies and standardized baselines	CHOOSE METHODOLOGY 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)
SDG Impacts:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16 and 17
Estimated amount of total GHG emission reductions	Ex-ante estimate: 58,191 CoUs/yr (58,191 tCO_{2eq}/yr)

SECTION A. Description of project activity

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

The project titled "90 MW Sugarcane Bagasse based co-generation Energy BEVAP Bioenergia" is composed of a sugar cane plant, located in the city of João Pinheiro in the state of Minas Gerais, Brazil.

The Bevap project was born with 3 machines registered with Bevap, with powers of 25/25/30 MW (see ordinance PRT2009126 MME).
Subsequently, Bevap decided to create Enervale, which, in lending, acquired the right to use the condensation machine (UG3), purchasing steam from Bevap.
Subsequently, the UG1 turbine underwent retrofitting, changing its power from 25 MW to 30 MW
With this, they established the two generating UTEs, granted by resolutions REA20112925 (Bevap – 60MW) and REA20123439 (Enervale – 30 MW).

Unit	Installed Capacity	Location	Commercial Operation Date
UTE Bioenergética Vale do Paracatu (BEVAP), UG01	30 MW	João Pinheiro, Minas Gerais	February 15, 2011
UTE Bioenergética Vale do Paracatu (BEVAP), UG02	30 MW	João Pinheiro, Minas Gerais	October 29, 2011
UTE Enervale	30 MW	João Pinheiro, Minas Gerais	July 26, 2012

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.

The activity currently consumes more of 800 thousand tons of biomass for generation clean energy and produces more than 270,000 MWh of electrical energy per year and, of this total, and 150,000 MWh are injected into the Brazilian electrical system, enough to supply a city of approximately 69,000 inhabitants, and thereby contributes to climate change mitigation efforts.

João Pinheiro Plant:

Bevap is a sugarcane processing industry and operates on three major business fronts: production and marketing of crystal sugar and VHP, anhydrous and hydrated ethanol, and cogeneration of electricity. The company's competitiveness is structured around a strategy that seeks to promote innovative and sustainable operations, based on the highest standards of corporate governance, the adoption of best practices in agricultural management, food production and renewable fuels. The company's development is based on its socio-environmental responsibility, promoting human development and environmental preservation, increasingly aligned with the dynamism of the ESG agenda and the demands of customers and business partners.

A.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:**
- The project activity contributes to employment generation in the local area. Currently, Bevap employs more than 1,840 people in the agricultural, industrial and administrative areas. The main strategy of Bevap's Human Resources area is to cultivate a people-driven work environment, developing and preparing employees to enhance performance with a focus on delivering results. The preparation of employees goes beyond strategic planning; it includes the benefits achieved by investments in human development. Bevap offered 86,168 training hours to its employees in the 2023/2024 Harvest.
- Bevap has a substantial impact on job creation and local revenues. In addition, generating business with producers of all sizes affects the purchasing power and quality of life of many families in the community. To further enhance the promotion of regional development, the company invests in specific projects and actions of a social nature. The projects offer access to education, professional training, culture, income generation and increase in the quality of life in the municipalities surrounding its operations: Brasilândia de Minas, Paracatu, Unaí and João Pinheiro.
- The Bevap Cultural Project fosters art and culture in the Northwest region of the state of Minas Gerais, especially in the cities of Brasilândia de Minas and João Pinheiro. Through various free cultural activities, the event provides opportunities for the community to participate in courses, workshops, conversation circles, artistic presentations, concerts, musicals, dance, theater, literature, painting, making musical instruments with recyclable materials and circus, through free activities for all ages. Bevap Cultural is a large event that integrates art and education with a strong economic impact on the municipalities where it is held.

- **Environmental benefits:**
- Avoids global and local environmental pollution, leading to reduction of GHG emissions.
- Bevap considers environmental conservation to be a material and priority topic. The company invests in the best technological practices that support the mitigation of its impacts. It is an assiduous and active participant in associations and outside committees that guide the resources involved in its operations and consistently promotes actions that seek to foster environmental awareness of its internal and external audiences. The company offers the Green Line, an exclusive communication channel for registering issues related to the environment and sustainability. In the 2023/2024 Harvest period, the company registered 108 contacts, all properly handled and resolved.
- Promote the recovery of degraded areas and reforestation actions according to the characteristics of the region.
- Develop actions aimed at its different stakeholders that promote awareness of the conscious and rational use of natural resources.
- Perform pest control periodically, prioritizing good agronomic practices and focusing on safe food.
- Monitor and respect the legally required percentage of protected areas and, when necessary, implement appropriate environmental compensation.

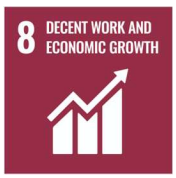
- Ensure full compliance with all relevant environmental licenses and legislation applicable to its businesses.
- Monitor and manage plants and programs that address their atmospheric emissions, effluents, waste and water management.
- The focus on efficient water resource usage extends to the industrial plant as well. All the water from the initial processing of sugarcane is reused in other processes of the industry, such as closed cooling systems and the reuse of condensation, which in this harvest reached the recovery of 97% of the condensed water.
- All residues from its processing, bagasse, vinasse, filter cake and ash, are used as fertilizers or by-products. The company embraces this concept because, in addition to reusing productive waste that would otherwise require treatment or disposal, it reduces dependence on natural resources, ensuring continuity in its production processes.
- Bevap 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. Nowadays, Bevap Bioenergia produces 86,000 m^3 of fuel per year, distributed into anhydrous ethanol, used as an additive for gasoline, and hydrated ethanol, which is commercialized as final fuel for vehicles.

- **Economic benefits:**
- Greater supply of cheap energy, ensuring the development of the region.
- Ensure the growth of region where Bevap is installed, providing clean and cheaper energy, ensuring the creation of jobs and business opportunities.
- Low-cost energy to consumers.
- Clean technology development in Brazil.
- Investments in new technologies.
- Investment in responsible consumption and production actions.

Bevap contribute significantly to economic, environmental and social matters, however, 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	Income generation through the creation of more than 1,800 jobs and training of workers to the job.
	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	The company adopts sustainable agricultural practices, such as the use of organomineral fertilizers and Integrated Pest Management, contributing to more sustainable agriculture.

	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	Provides health plans for all employees, offers a medical outpatient clinic and provides the assistance of a nursing team 24 hours a day. In addition, three times a week, a doctor is available to employees and third parties workers for consultations, including electives
	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	Investment in training and development programs, such as Plataforma Crescer, which offered 17,810 hours of training in the 2023/2024 Harvest. Offered training to more than 50 Brasilândia de Minas residents, promoting professional qualification and strengthening of the local workforce. The Young Apprentice Program offers professional training opportunities for young people in the community.
	5.5 - Ensure women's full and effective participation and equal opportunities for leadership at all levels of decisionmaking in political, economic and public life	The company values gender diversity and is committed to promoting na inclusive and equitable environment. To support this, it invests in creating affirmative opportunities for women and in their professional development. The female presence inspires other professionals and supports empowerment so that they can gain independence and take more charge of their lives.
	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	Implements efficient water management practices, such as the use of automated irrigation systems and monitoring of water availability in waterways. All the water from the initial processing of sugarcane is reused in other processes of the industry, such as closed cooling systems and the reuse of condensation, which in this harvest reached the recovery of 97% of the condensed water.

	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 1,840 jobs. The company implemented programs such as PAS (Safe Attitude Program) and Befit, aiming to improve the health and safety of employees. The company created the Human and Organizational Development (DHO) area. This initiative reflects the company's commitment to promote employee well-being and strengthen organizational culture.
	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	A modern industry installed in an area of 130 hectares and uses advanced technology in its operations, such as the Industrial Operations Center (COI) and the Agricultural Operations Center (COA). Bevap employs autopilot equipment in its operations, aiming to reduce trampling and soil compaction.
	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	Bevap signed the UN Declaration of Women's Empowerment Principles, with the aim of empowering women and promoting gender equality, thus ensuring the effective strengthening of economies, boosting business, improving the quality of life of women, men and children, and for sustainable development.

	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: the company guaranteed internet access to several municipalities in the region with the installation of a 4G antenna.
	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	Waste management practices, including a dedicated center for receiving and sorting solid waste.
	13.2 – Integrate climate change measures into national policies, strategies and planning.	it has certifications such as RenovaBio and ISCC, which attest to compliance with environmental and sustainability criteria. Furthermore, the production of biofuels and renewable energy contributes to the reduction of greenhouse gas emissions.
	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. 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	In the last 7 years, more than 55,400 seedlings were planted in a total area of interventions that exceeded 12 hectares. More than 18,000 hectares of Legal Reserves and Permanent Protection Areas All species that were critically endangered or threatened with extinction no longer fall within this level of risk.
	16.6 - Develop effective, accountable and transparent institutions at all levels	Code of Ethics and Conduct and a Reporting Channel, promoting transparency and integrity in its operations.

	17.17 - Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	The company maintains partnerships with institutions such as the State Forestry Institute (IEF) for restoration and reforestation initiatives.

A.3. Location of project activity >>

Country: Brazil
District: João Pinheiro
State: Minas Gerais
Zip Code: 38770-000

Latitude: -17.0622º
Longitude: -46.1836º

A.4. Technologies/measures >>

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

João Pinheiro Plant:

Boilers

Powerhouse

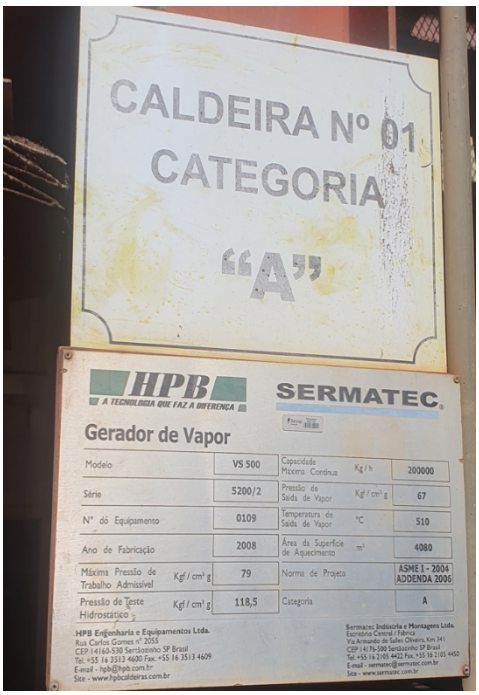
Power Generator 1 and 2

Power Generator 1, 2 and 3

Sugarcane bagasse stock

The system consists of three energy generating units, which are supplied by two boilers:

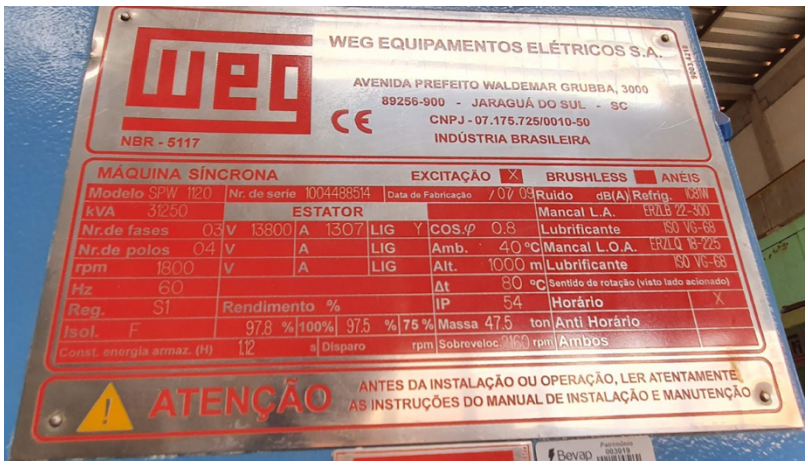
Boiler	**Nº 01**	**Nº 02**
Manufacturer	HPB Engenharia / Sermatec	Sermatec - Zanini
Capacity (Tons/h)	200	200
Serial number	5200/2 / 0109	7.6315
Year of manufacturer	2008	2010
Maximum allowable working pressure (kgf/cm^{2}g)	79	79
Hydrostatic Test Pressure (kgf/cm^{2}g)	118,5	118,5
Pressure (kgf/cm^2)	67	67
Degree of super heat ºC (Steam)	510	510
Heating surface area (m^2)	4080	4080
Design Standard	ASME I -2004 ADDENDA 2006	ASME I -2004 ADDENDA 2005
category	A	A



Boiler nº 1

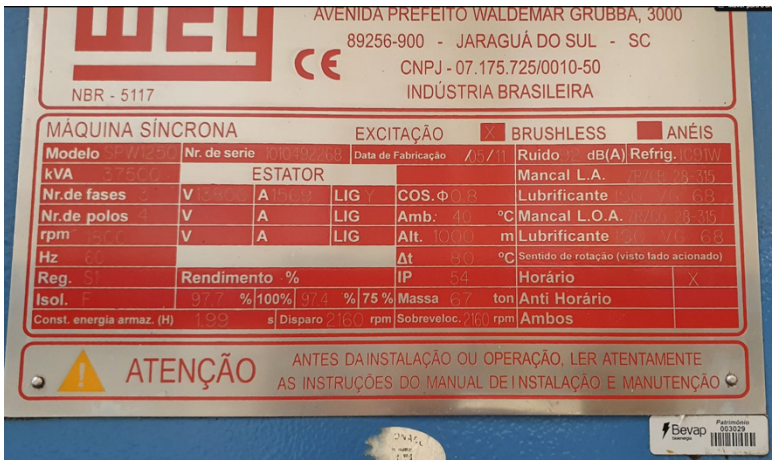
Boiler nº 2

Alternator/ Generator	№ 1	№ 2	№ 3
Year of manufacturer	July 2009	April 2011	May 2011
Manufacturer	WEG	WEG	WEG
Power Rated (kVA)	31,250	31,250	37,500
Serial Number	1004488514	1010184150	1010492268
Voltage (V)	13,800	13,800	13,800
Current (Amps)	1,307	2,092	2,092
Power Factor (cos φ)	0.80	0.80	0.80
Efficiency (25%, 50%, 75%, 100% of load)	75%, 97.5%, 100%, 97.8%	75%, 97.6%, 100%, 97.9%	75%, 97.4%, 100%, 97.7%
Generator Rated Speed (rpm)	1,800	1,800	1,800
Frequency (Hz)	60	60	60
Generator Model	SPW 1120	SPW 1120	SPW 1250



Alternator/ Generator nº 1

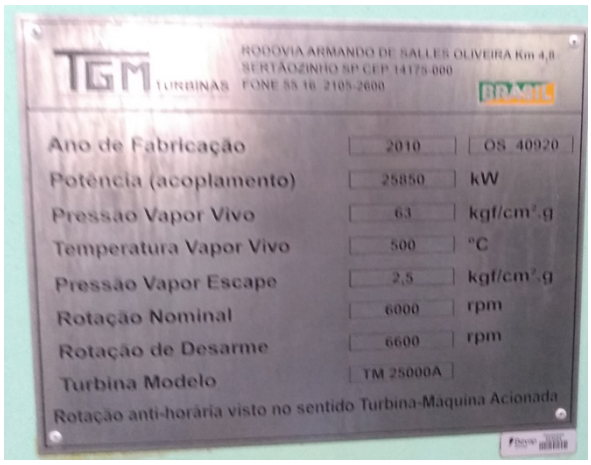
Alternator/ Generator nº 2



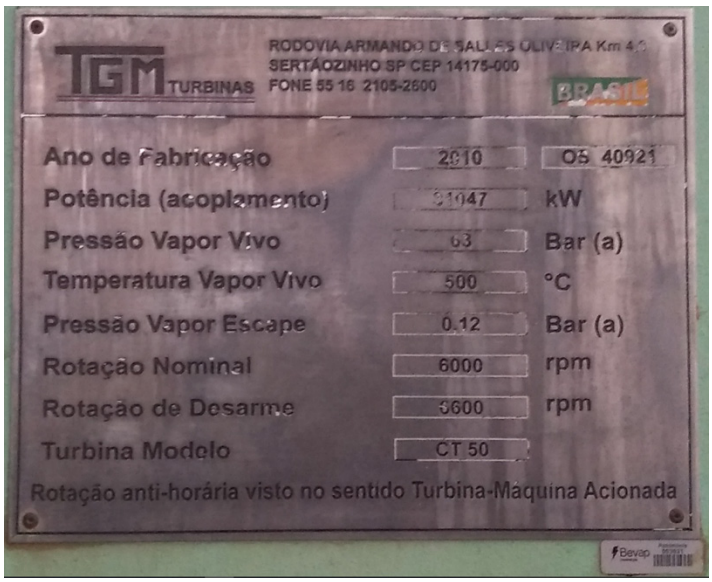
Alternator/ Generator nº 3

Turbine	Nº 1	Nº 2	Nº 3
Year of manufacturer	2008	2010	2010
Manufacturer	TGM Turbinas	TGM Turbinas	TGM Turbinas
Power Rated (kW)	25,846	25,850	31,047
Live Steam Pressure (Bar)	63	63	63
Live Steam Temperature (ºC)	500	500	500
Steam Exhaust Pressure (Bar)	2.5	2.5	2.5
Turbine Rated Speed (rpm)	6,000	6,000	6,000
Turbine Disarm Speed (rpm)	6,600	6,600	6,600
Turbine Model	TM 25000 A	TM 25000 A	CT 50

Turbine nº 1



Turbine nº 2



Turbine nº 3

A.5. Parties and project participants >>

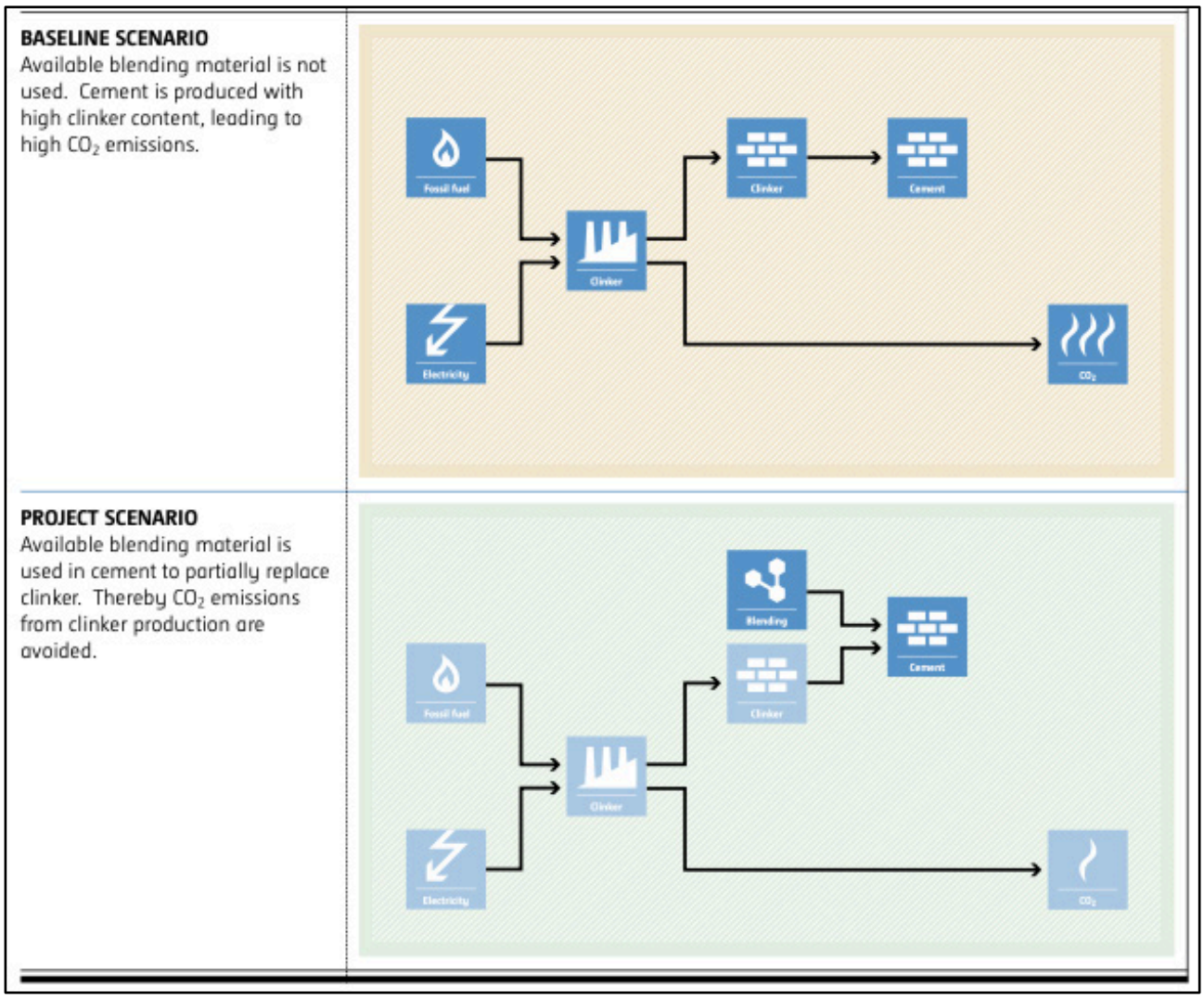
Party (Host)	Participants
Brazil	**Owner:** Bioenergética Vale do Paracatu – BEVAP Bioenergia Rodovia MG-181 - Km 85 Estrada da Fazenda São Geraldo João Pinheiro – MG Zip Code: 38770-970 https://www.bevapbioenergia.com.br/ **Aggregator:** FastCarbon Consultoria e Negócios Ltda Rua Viradouro, 63, conjunto 61, Itaim Bibi São Paulo/SP Zip Code: 04538-110

A.6. Baseline Emissions>>

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.

ACM0006 Electricity and heat generation from biomass



A.7. Debundling>>

This "90 MW Sugarcane Bagasse based co-generation Energy BEVAP Bioenergia" 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 B. Application of methodologies and standardized baselines

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

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

TYPE I - Renewable Energy Projects

CATEGORY - ACM0006: "Electricity and heat generation from biomass" Version 16.0

B.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 90 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.

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.

B.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.

Bevap Bioenergia 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.

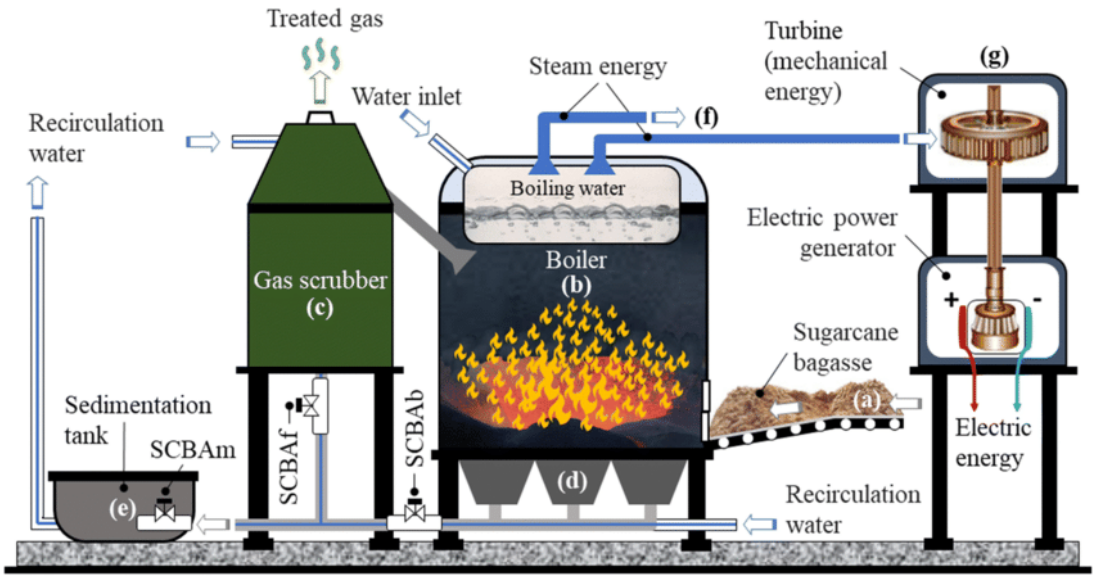
Although RenovaBio and the carbon credit certification system have similar objectives with regard to decarbonization, they are different programs and work in different ways, with their own regulations and mechanisms. However, to adopt a conservative position and avoid double counting, the percentage 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.

B.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 $LE_y = 0$

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,

$PE_{Biomass},CH_4,y$ = 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, $PE_y = 0$.

B.5. Establishment and description of baseline scenario (UCR Standard or Methodology) >>

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 2014 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" ($t\ CO_2/MWh$)

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:

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

For the Build and Operation margin emission factor, was considered the public data for the year of 2020 available in the Ministry of Science, Technology and Innovation website

OM = 0.4539

BM = 0.0979

Resulting in $EF_{grid,CM,y}$ = 0.2759

Estimated power generation per year as 234,352 MWh,

Resulting in *BEy* = 64,657 tCO_2

Since the project is a biomass co-generation project:

PEy = 0
LEy = 0

So as result *ERy* = *BEy*

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.

ERy = 64,657 x 0.9 = 58,191 tCO_2 / year

Estimated Annual emission reductions: ERy = 58,191 tCO_2 / year (58,191 CoUs /year)

B.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.

Bevap Bionenergia 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** (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

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.

- **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.

B.7. Changes to start date of crediting period >>

Crediting period start: 01/01/2013.
There is no change in the start date of crediting period.

B.8. 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.

B.9. Monitoring period number and duration>>

First Issuance Period: 12 years – 01/01/2013 to 31/12/2024

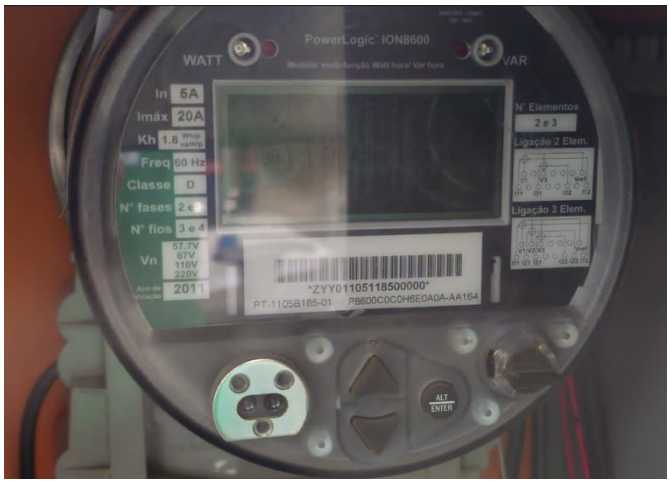
B.8. Monitoring plan>>

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

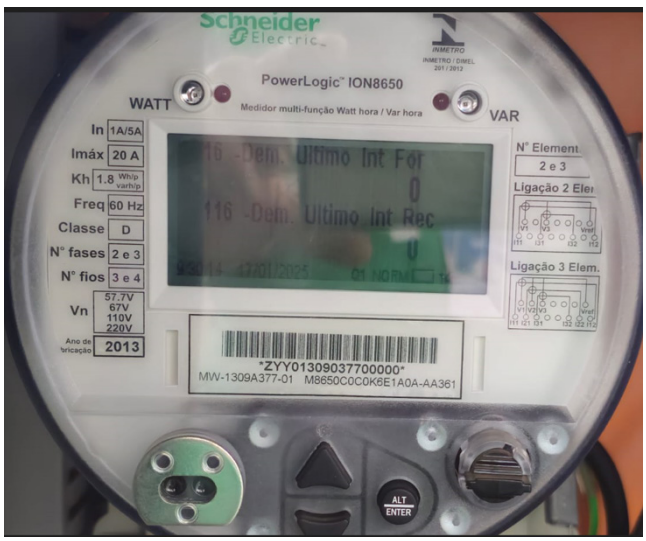
Meter	Serial Number	Specification
1	PT-1201A390-01 (Main)	Schneider Power Logic ION8600 3 Phases 57.7 ~ 220 V 5.0 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2012 Last Calibration: 05/09/2022
2	PT-1105B185-01 (Check)	Schneider Power Logic ION8600 3 Phases 57.7 ~ 220 V 5.0 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2011 Last Calibration: 05/09/2022
3	MW-1309A377-01 (Main)	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: 2013 Last Calibration: 05/09/2022

4	MW-1309A724-01 (Check)	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: 2013 Last Calibration: 05/09/2022

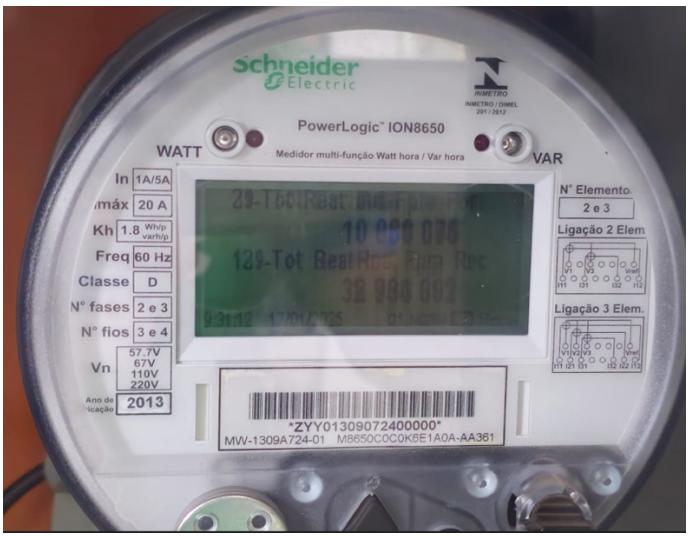
Meter 1 (UTE Enervale Main)



Meter 2 (UTE Enervale Check)



Meter 3 (UTE BEVAP Main)



Meter 4 (UTE BEVAP 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 Bevap personnel through CCEE system at CCEE website.

Parameters being monitored or used in emission reductions determination:

Data/Parameter	$EF_{grid,y}$
Data unit	tCO2e/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.