PROJECT CONCEPT NOTE

CARBON OFFSET UNIT (CoU) PROJECT



Title: 156.3 MW Sugarcane-Bagasse-Based Cogeneration Energy Project – COCAL TERMOELÉTRICA S/A

Version 1.0
Date September 30, 2026
First CoU Issuance Period: 13 years
From Jan 01, 2013 to Dec 31, 2025

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

BASIC INFORMATION	
Title of the project activity	156.3 MW Sugarcane-Bagasse-Based Cogeneration Energy Project – COCAL TERMOELÉTRICA S/A
Scale of the project activity	Large Scale
Completion date of the PCN	September 30, 2026
Project participants	COCAL TERMOELÉTRICA S/A (OWNER) FASTCARBON (AGGREGATOR)
Host Party	BRAZIL
Applied methodologies and standardized baselines	CHOOSE METHODOLOGY CDM UNFCCC 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, 14, 15, 16 and 17
Ex-ante estimated amount of total GHG emission reductions	67,446 CoUs/yr (67,446 tCO_{2eq}/yr)

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SECTION A. Description of project activity

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

The purpose of the Carbon Offset Unit (CoU) project activity, entitled "156.3 MW Sugarcane-Bagasse-Based Cogeneration Energy Project – COCAL TERMOELÉTRICA S/A", is the generation of renewable electricity through the combustion of sugarcane bagasse at two thermoelectric plants, located in the cities of Paraguaçu Paulista and Narandiba in the state of São Paulo, Brazil.

The surplus renewable electricity exported to the distribution system displaces grid electricity that would otherwise be generated by fossil-fuel-based thermoelectric sources, resulting in greenhouse gas (GHG) emission reductions. The project utilizes sugarcane bagasse, an abundant by-product of Cocal's sugar and ethanol milling operations, as its primary fuel and converts this biomass residue into renewable electricity, contributing to the diversification of Brazil's energy matrix and its decarbonization goals.

The UCR project activity consists of the construction and operation of power plants that use renewable energy sources to supply 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. o enhance the project's credibility, a full additionality assessment is provided in Section A.8 as supporting evidence for third-party rating purposes.

The project was initiated following the authorization granted to **COCAL TERMOELÉTRICA S/A** to establish itself as an Independent Power Producer through the development and operation of the thermoelectric power plant named **"UTE 1 – Cocal Paraguaçu Paulista (PPT)"**, equipped with a 25 MW generating unit.
ANEEL Resolution Nº 560, dated December 17, 2001, records that the 25,000 kW turbogenerator of the plant has been "in operation since August 2001. It should be clarified that this date refers to the commissioning of the unit for self-consumption — a condition under which the facility previously operated as a self-producer (authorization granted by ANEEL Order Nº 427, dated October 6, 2000). Operation for self-consumption must not be confused with the export of surplus energy to the grid: the latter only became legally possible after the execution of the system access contracts, as required by the applicable regulation.
The instrument that enabled such export is the Distribution System Use Contract (CUSD – Contrato de Uso do Sistema de Distribuição), entered into between Cocal Termoelétrica S.A. and Empresa de Eletricidade Vale Paranapanema S/A (the distribution concessionaire), signed on January 1, 2002, with effect from February 11, 2002. The contract establishes the power made available to the grid — i.e., the energy effectively injected — on a staggered basis: 10,000 kW in the first phase (February 11, 2002 to May 15, 2002) and 21,000 kW in the second phase (from May 16, 2002 onward). Prior to the effectiveness of this contract, the plant did not hold the right to use the distribution system and, therefore, could not export energy to the grid.
This milestone is corroborated by ANEEL Resolution Nº 236, dated April 25, 2002, which approved the transfer of authorization to Cocal Termoelétrica S.A., likewise with effect from February 11, 2002 — the same effective date of the CUSD.
In light of the above, it is concluded that the export of electricity to the grid by UTE Cocal began on February 11, 2002, notwithstanding the fact that the generating unit had already been in operation for self-consumption since August 2001.

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UTE Cocal – Paraguaçu Paulista (PPT): Supporting documents and regulatory timeline:

- ANEEL Resolution Nº 560/2001 — authorization as Independent Power Producer;
- ANEEL Resolution Nº 236/2002 — transfer of ownership to Cocal Termoelétrica S.A.;
- Distribution System Use Contract (CUSD), dated January 1, 2002.
- Start of energy export: February 11, 2002

In 2008, the second unit, located in Narandiba, was inaugurated, expanding the company's business operations. Subsequently, through ANEEL Authorizing Resolution Nº 1,404, dated June 10, 2008, Cocal was authorized to establish itself as an Independent Power Producer, through the implementation and operation of UTE Cocal II, located in Narandiba (NRD), equipped with a turbogenerator with an installed capacity of 40,000 kW, using sugarcane bagasse as fuel.

Subsequently, the capacity was increased by another 40 MW, bringing the total to 80 MW. Finally, an additional 51.3 MW generating unit was added, bringing the total to 131.3 MW.

UTE Cocal II — Narandiba (NRD): Regulatory Timeline and Generating Units:

UG1 — 40 MW

- ANEEL Authorizing Resolution Nº 1,404, dated June 10, 2008 — Authorization granted to Cocal to establish itself as an Independent Power Producer through the implementation and operation of UG1, with an installed capacity of 40 MW, using sugarcane bagasse as fuel.
- Dispatch ANEEL nº 4,229, dated November 16, 2009 — Authorization for the commencement of reliability tests of UG1 (40 MW), effective from November 17, 2009.
- ANEEL Order Nº 19, dated January 7, 2010 — Authorization for the commencement of commercial operation of UG1 (40 MW), effective from January 8, 2010.

UG2 — 40 MW (Plant expansion to 80 MW)

- Dispatch ANEEL nº 1,537, dated June 1, 2010 — Authorization to expand the installed capacity through the addition of UG2 (40 MW), bringing the plant's total to 80 MW. Authorization for the commencement of reliability tests of UG2, effective from June 2, 2010.
- Dispatch ANEEL nº 1,844, dated June 28, 2010 — Authorization for the commencement of commercial operation of UG2 (40 MW), effective from June 29, 2010.

UG3 — 51.3 MW (Plant expansion to 131.3 MW)

- Dispatch ANEEL nº 3,051, dated August 7, 2014 — Authorization for the commencement of reliability tests of a new generating unit, UG3 (51.3 MW), effective from August 8, 2014.
- Dispatch ANEEL nº 3,783, dated September 18, 2014 — Authorization for the commencement of commercial operation of UG3 (51.3 MW), effective from September 19, 2014.

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Unit	Installed Capacity	Location	Commercial Operation Date
UTE 1 – Cocal Paraguaçu Paulista (PPT)	25 MW	Paraguaçu Paulista São Paulo	February 11, 2002 (the distribution system use contract between Cocal Termoelétrica S.A. and Empresa de Eletricidade Vale Paranapanema S/A)
UTE 2 – Cocal II Narandiba (NRD)	131.3 MW (UG1: 40 MW + UG2: 40 MW + UG3: 51.3 MW)	Narandiba São Paulo	January 8, 2010 (Dispatch nº 19 of January 7, 2010 - ANEEL) June 29, 2010 (Dispatch nº 1,844 of June 28, 2010 - ANEEL) September 19, 2014 (Dispatch nº 3,783 of September 18, 2014 - ANEEL)

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

Cocal Paraguaçu Paulista (PPT):

- LO 59002910 – Licensing and Operation dated August 13, 2024, valid until August 13, 2026, with the Protocol for Request to Renew the operating license Nº CETESB.015281/2026-38, from the date of March 13, 2026

Cocal Narandiba (NRD):

- LO 12004797 – Licensing and Operation dated June 3, 2026, valid until December 16, 2030;

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Company History, Growth, and Key Milestones

Cocal was founded on May 14, 1980, in Paraguaçu Paulista, State of São Paulo, originally as an ethanol producer. Over more than four decades, the company has evolved into one of the leading references in the Brazilian sugar-energy sector, guided by a circular economy model that maximizes the full utilization of sugarcane.

Key Milestones:

1980: Foundation of Cocal in Paraguaçu Paulista/SP, initially focused on ethanol production.
1994: Diversification into sugar production, expanding the product portfolio.
2002: Pioneering cogeneration of electricity from sugarcane bagasse
2006: Strategic partnership established with Copersucar, becoming one of its largest cooperative members.
2008: Inauguration of the second industrial unit in Narandiba/SP
2020: Certification under RenovaBio, Brazil's national biofuels policy.
2021: IFC (World Bank Group) financing of US$70 million to expand ethanol and biogas production and improve energy efficiency. Expansion into biogas, food-grade CO_2, and dry yeast production.
2023: Inauguration of the first photovoltaic solar plant in Pirapozinho/SP.
2025: Acquisition of the Rio Brilhante and Passa Tempo units from Raízen in Mato Grosso do Sul, completed in December 2025, with an investment of approximately BRL 1.5 billion, adding 6 million tons of sugarcane crushing capacity and expanding the company's geographic footprint into a second state.
Construction of a new biogas plant in Paraguaçu Paulista and a second photovoltaic plant in Presidente Bernardes/SP

Acquisitions and Expansion:

The acquisition of the Rio Brilhante and Passa Tempo units from Raízen, concluded in December 2025, represented the largest single expansion in Cocal's history. The transaction, valued at approximately BRL 1.5 billion (~USD 275.9 million), increased the company's crushing capacity from 10.3 million to over 16 million tons of sugarcane per harvest, consolidated four industrial units across two states, and expanded the workforce to over 8,000 employees.

The scope of this Carbon Offset Unit (CoU) project activity is limited to the renewable electricity exported to the Brazilian interconnected grid from sugarcane bagasse cogeneration at Cocal's two original industrial units located in the State of São Paulo — UTE Cocal I (Paraguaçu Paulista, 25 MW, grid export since February 11, 2002) and UTE Cocal II (Narandiba, 131.3 MW across UG1, UG2, and UG3, with commercial operations beginning in January 2010, June 2010, and September 2014, respectively). The project boundary does not include electricity generated from photovoltaic solar plants, biogas, biomethane, or any other renewable energy source or activity currently operated or under development by Cocal. It also does not encompass the industrial units acquired from Raízen in December 2025 (Rio Brilhante and Passa Tempo, State of Mato Grosso do Sul). Such excluded activities and assets may, where applicable, give rise to separate carbon offset projects under their own project boundaries, crediting periods, and baseline methodologies, and are therefore intentionally excluded from the scope of this CoU project activity to ensure clarity and avoid double counting.

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Products and Production Volumes — Pre-Acquisition (2 units: Paraguaçu Paulista + Narandiba, SP)

- Industrial units: 2 (Paraguaçu Paulista and Narandiba, State of São Paulo)
- Sugarcane crushing capacity: 10.3 million tons/year
- Area under management: 114,500 hectares
- Sugar production capacity: ~720,000 tons/year
- Ethanol production capacity: ~400 million liters/year
- Electricity export capacity: 470,000 MWh/year
- Biomethane production: ~8 million Nm^3/year
- Dry yeast production: ~7,000 tons/year
- Food-grade CO_2 production: 16,000 tons/year (48 tons/day)
- Biofertilizers: 31,000 tons/year
- Employees: ~4,959

Post-Acquisition Operational Capacity (4 units: + Rio Brilhante + Passa Tempo, SP and MS)

- Industrial units: 4 (Paraguaçu Paulista, Narandiba, Rio Brilhante, and Passa Tempo — States of São Paulo and Mato Grosso do Sul)
- Sugarcane crushing capacity: 16 million tons/year
- Area under management: 257,000 hectares
- Sugar production capacity: ~1,000,000 tons/year
- Ethanol production capacity: 595 million liters/year
- Electricity export capacity: 686,000 MWh/year
- Biomethane production: 27 million Nm^3/year
- Dry yeast production: 7,300 tons/year
- Food-grade CO_2 production: not disclosed for the combined entity
- Biofertilizers: not disclosed for the combined entity
- Employees: 8,000+



Cocal Narandiba



Cocal Paraguaçu Paulista

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

This section demonstrates that the CoU project activity, comprising the export of renewable electricity from sugarcane bagasse cogeneration at UTE Cocal I (Paraguaçu Paulista) and UTE Cocal II (Narandiba), does not cause net harm to the environment, society, or local communities, and that appropriate mitigation measures are in place for any identified impacts.

The project activity generates measurable social, environmental and economic benefits, detailed below.

Social benefits:

- *Labor Practices and Human Rights:* Cocal employed 4,959 personnel in the 2024/2025 harvest year (82.5% male, 17.5% female), with commitments to diversity, equity, and inclusion. The company holds the Great Place to Work (GPTW) certification and the Child-Friendly Company Seal. Freedom of association and collective bargaining are guaranteed, with active engagement with trade unions. No child labor or forced labor has been identified in the company's operations or supply chain.

- *Occupational Health and Safety:* Cocal maintains a zero-rate for accidents resulting in time off work at both units (2024/2025 harvest). The safety management system is based on the "Golden Lives" tool, comprising five axes: Safe Behavior, Risk Assessment and Management, Environmental Protection, Responsible Leadership, and Relationship with Partner Companies. Training hours averaged 31.6 hours per male employee and 17.9 hours per female employee in the 2024/2025 cycle.

- *Community Relations:* Cocal invests in social projects in the communities surrounding its operations, with over USD 134,000 invested in the 2024/2025 harvest across initiatives including the Scholarship Program, Projeto Solidário (operating in seven cities), and cultural/sports programs benefiting over 600 students. According to GRI 413-2, no significant actual or potential negative impacts on local communities were identified. The company maintains active stakeholder engagement with communities through meetings, social media, and structured dialogue channels.

Environmental benefits:

- *Water Resources:* Cocal's operations are located in areas classified as low water risk according to the WRI Water Risk Atlas. Water withdrawal is carried out from surface and groundwater sources legally authorized by the competent environmental agency, within the Médio Paranapanema and Pontal do Paranapanema Drainage Basins. Industrial water is managed through closed-circuit reuse systems, maintaining a reuse rate exceeding 95%. The company consumes less than 1 m^3 of water per ton of processed sugarcane, in compliance with the environmental protocol of the Etanol + Verde (Greener Ethanol) Program. Cocal does not discharge effluents into water bodies; all household and industrial effluents are treated and incorporated into vinasse for crop fertigation. No negative impacts on water resources have been identified.

- *Waste Management:* Cocal operates under a Solid and Liquid Waste Management Plan compliant with Brazilian Standard NBR 10004:2004 and the National Solid Waste Policy. 100% of solid and liquid waste is tracked through Waste Transport Manifests (WTM) with Final Destination Certificates (FDC), managed via the State Online Solid Waste Management System (Sigor/Cetesb). 100% of agro-industrial byproducts are reused — including filter cake, vinasse, bagasse, and straw — either as inputs for biofertilizers, biogas production, or animal nutrition. No untracked waste disposal occurs.

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- *Air Quality and GHG Emissions:* The project activity directly contributes to GHG emission reductions by displacing fossil-fuel-based grid electricity. Cocal's plants operate with 100% renewable electricity generated from sugarcane biomass, achieving energy self-sufficiency. In the 2024/2025 harvest year, the company reported a reduction of 27,595 tCO_2e in Scope 3 emissions through decarbonization initiatives. The company's energy-environmental efficiency rating (NEEA) under RenovaBio has shown continuous improvement, with gains of 8.55% at Paraguaçu Paulista and 5.07% at Narandiba since certification. The surplus electricity exported to the grid is sufficient to supply a city of up to approximately 730,000 inhabitants, according to the company's own assessment.

- *Soil and Land Use:* Harvesting is 100% mechanized, eliminating the practice of pre-harvest sugarcane burning. Precision agriculture is deployed across all agricultural areas, with full field connectivity, drones, sensors, and autopilot-equipped machinery. Fertigation with vinasse and application of filter cake and biofertilizers (31,000 tons/year) reduce dependence on synthetic fertilizers and promote soil health. Plant protection products are handled exclusively by trained professionals using precision dosing systems, minimizing soil contamination risks.

- *Biodiversity and Conservation:* Cocal's Environmental Management Policy establishes biodiversity conservation as a pillar of its Corporate ESG Policy. There are no areas of high biological value in the vicinity of the facilities. Biodiversity monitoring has been conducted since 2017. Cocal was the first company to receive the "Nascentes" seal for voluntary forest restoration. The company implements strict measures to protect natural ecosystems and native species through area protection and reforestation programs.

- *Climate Resilience:* Cocal adopts climate-smart agriculture platforms (SCP) providing real-time data on climate conditions. New sugarcane varieties with greater resistance to water stress and nutrient-poor soils have been developed. The company maintains fire-prevention and firefighting programs, which are identified as material topics under its ESG framework.

Economic benefits:

- *Local Economic Development:* The company is a major employer in the western São Paulo region, generating approximately 5,000 direct jobs (pre-acquisition) and contributing to regional economic development through salary mass, tax revenue, and procurement from local suppliers. The company's due diligence platform validates suppliers against technical, labor, social security, environmental, and occupational safety criteria.

Governance and Compliance

- Cocal operates under a formal Corporate ESG Policy and Environmental Management Policy. The Integrity Program (Programa Integridade) identifies potential negative impacts, risks, and improvement opportunities. An anti-corruption policy and conflicts-of-interest prevention measures are in place. The company complies with all applicable Brazilian laws and regulations, including environmental licensing requirements, ANEEL regulations, and labor legislation. Third-party sustainability certifications, including Bonsucro, ISCC PLUS, ISCC CORSIA PLUS, RenovaBio, and the Green Energy Certificate (UNICA), subject the company's operations to regular independent audits covering environmental, social, and economic governance criteria.

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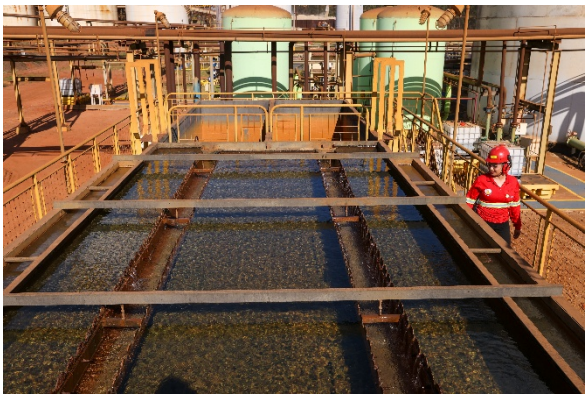
Life and Career Project



Mobile clinic



Relationships with universities - FATEC



Water Treatment Plant



Training programs



Gender Equality – Women's Day Campaign

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Biomethane-powered truck



Agricultural Laboratory



GPTW Seal



Biofactory



Cotesia: parasitoid micro-wasp used for the biological control of agricultural pests



Release of Cotesia via drone

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innovation in the agricultural



Program: Pooling Ideas



Program: Golden Youth



Program to combat illegal fishing



Polymorphic Information Content

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COCAL TERMOELÉTRICA S/A contributes significantly to economic, environmental, and social development. The company's activities contribute to all 17 SDGs.

SDG	Target	How was it achieved?
	1.1 – By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.90 a day 1.2 - By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	Job creation (~4,959 employees) and economic contribution to local communities through taxes (USD 1,379,375.00 in the 2025/2026 season), local hiring, and partnerships. Support for social projects via incentive laws.
	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	Regenerative agriculture: minimum tillage, crop rotation, 85% of the area with targeted vinasse application. Production of VHP sugar (720 thousand tonnes) and dry yeast for animal nutrition (4.66 thousand tonnes) 100% mechanized harvesting, without straw burning (São Paulo Agro-environmental Protocol)
	3.4 - By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental 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 3.9 – By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	Annual flu vaccination campaigns, information campaigns on disease prevention, Mobile Clinic, Ambulance available 24 hours a day "Safety First" Program (zero lost-time accidents across three cycles); annual SIPAT (Internal Accident Prevention Week); PCMSO, PCA, PPR, and PGR programs; in-vehicle fatigue monitoring cameras; monthly safety inspections (SSMAS); promotion of employee physical and mental health. Health insurance for all employees

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	4.3 - By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, at affordable prices, including university 4.4 - By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship 4.7 - By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	Employee development through the "Crescer Mais" Program. Cocal offers a scholarship program that covers a percentage of undergraduate and postgraduate tuition fees for employees. Free courses for the community, such as the Life and Career Project Partnerships with universities and educational institutions Inauguration of the technology room at FATEC Pompeia The Jovem Digital Project, which offers free computer courses to students
	5.1 – End all forms of discrimination against all women and girls everywhere 5.5 - Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	Training women for work in the agricultural sector Annual campaigns celebrating International Women's Day Code of Ethics and Conduct promoting gender equality
	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	Use of reuse systems and closed-loop circuits, and the repurposing of industrial effluents for fertigation in sugarcane fields. No discharge of effluents into rivers or streams, and continuous monitoring of the quality of treated effluents, surface water, and groundwater. Implementation of wastewater treatment plants at the units

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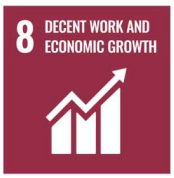
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix.	Facilities are operated entirely using renewable electricity generated from sugarcane biomass, with surplus energy supplied to utility companies and integrated into the National Interconnected System (SIN). To diversify the energy mix, investments were made in two photovoltaic plants, located in Pirapozinho and Presidente Bernardes, and in electricity generation from biogas. Complementing this strategy, two biomethane plants were established to replace diesel in internal and external operations.
	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	Implementation of recruitment and selection tools, such as trainee, internship, young professional, and apprentice programs. Certification by Great Place to Work (GPTW), a recognition reflecting a commitment to an excellent work environment. Code of Ethics and Conduct that prevents any form of exploitation, child labor, forced labor, or work analogous to slavery. Health and safety initiatives at Cocal are guided by the "Golden Lives" framework, which rests on five pillars: Safe Behavior, Risk Assessment and Management, Environmental Protection, Responsible Leadership, and Relationships with Partner Companies. We maintain a zero rate of lost-time accidents across our facilities.

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	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 9.5 - Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	Implementation of a multi-year strategic innovation plan to drive the development of innovative and sustainable solutions. Utilization of incentives under the "Lei do Bem" (Good Law) to foster research, development, and technological innovation. Entomology laboratory that produces “Cotesia flavipes” wasps in-house, released via drones for the biological control of the sugarcane borer. Seedling biofactory for developing sugarcane varieties better adapted to local soil and climate. Production of custom fertilizers at the Input Formulation Facility, developed according to the specific characteristics and needs of each cultivation area. Agricultural laboratory that performs in-house oil, soil, and fertilizer analyses, enhancing reliability in agricultural management.
	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 10.4 – Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	Implementation of social projects for children and adolescents, highlighting the “Atletas do Futuro”, “Jovens de Ouro”, and “Solar Musical” programs. Physical adaptations for the inclusion of people with disabilities in Paraguaçu Paulista and Narandiba operations. Periodic reviews of the Remuneration Policy, which establishes fair salary criteria for employees in similar roles or equivalent hierarchical levels, ensuring equity and equal treatment regardless of gender or any other factors.

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	11.4 - Strengthen efforts to protect and safeguard the world's cultural and natural heritage 11.a - Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	Projects for the conservation of Permanent Preservation Areas (APP) and Legal Reserves (RL), strengthening the protection of biodiversity and natural resources. Shared energy partnership, enabling the community to access renewable energy and reduce electricity bills. Energy donations to hospitals: 2,370 MWh (Barretos Cancer Hospital, Esperança, Santa Casa) Implementation of a pipeline for biomethane distribution
	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	Full valorization of agro-industrial by-products, promoting the circular economy. Sugarcane bagasse is used for electricity cogeneration; filter cake and vinasse are applied as fertilizers in sugarcane fields and also used to produce biogas and biomethane. Co-products from this process, such as Organogeo and Liquefértil, return to the fields as biofertilizers. Solid Waste Management Plan, covering the identification, segregation, storage, collection, transport, transshipment, treatment, and environmentally sound disposal of solid waste, as well as the final disposal of rejects.

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	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.	Use of smart agro-climatic monitoring platforms (PIC) that provide real-time information, historical data, and trends for the coming months. Partnerships to develop sugarcane varieties that are more resilient to climate change. Replacement of nitrogen fertilizers with organic fertilizers and biological inputs, and of diesel with biofuels such as ethanol and biomethane; and renewable energy production from biomass, biogas, and solar energy. Annual preparation of the greenhouse gas (GHG) emissions inventory and product life cycle assessment (LCA).
	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 14.4 - By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	Cocal implements reuse systems and closed-loop circuits, repurposing industrial effluents for fertigation in sugarcane fields. We do not discharge effluents into rivers or streams—which eventually flow into the sea and indirectly impact the oceans—and we continuously monitor the quality of treated effluents, surface water, and groundwater. Combating illegal fishing

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	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.	Preservation of Legal Reserve (RL) and Permanent Preservation Areas (APP) for the conservation of native fauna and flora, including reforestation programs. Monitoring of terrestrial wildlife within Cocal's territory; all rescued animals are taken to a non-governmental organization (NGO) specializing in rehabilitation and reintegration into their natural habitats.
	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 and Conduct and Anti-Corruption and Anti-Bribery Policy, establishing guidelines to prevent corruption, bribery, and conflicts of interest. Independent Ethics Channel for the safe and confidential reporting of actions that violate our Code of Ethics and Conduct. Corporate governance practices that strengthen transparency, integrity, and accountability in business management. Integrity Program, structured around four pillars: prevent, detect, respond, and monitor. The program encompasses corporate risk management, a Code of Ethics and Conduct, an independent ethics channel, third-party due diligence, identity management and segregation of duties (SoD), approval limits, regulatory compliance, LGPD, internal controls, internal audit, and investigations.

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	17.16 - Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries 17.17 - Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	Partnerships with research institutions, such as Embrapa, for the development and implementation of sustainable agricultural solutions. Partnership with GasBrasiliano for the implementation of the biomethane distribution pipeline. In Narandiba, a partnership was established with Lesaffre for the production of baker's yeast. The company will use sugarcane molasses, energy, and water supplied by Cocal and return the residual vinasse for biodigestion. In Paraguaçu Paulista: a partnership with Granja Shida involves supplying electricity and biomethane, while poultry manure is sent to Cocal's biodigesters. Strategic partnership with LOTS Group, a Scania Group company, to replace diesel in agricultural logistics. Inauguration of the technology room at FATEC Pompeia A partnership with Siemens and GIZ, an innovative project to analyze the production of green hydrogen, methanol, and sustainable aviation fuel (SAF) from sugarcane ethanol plants.

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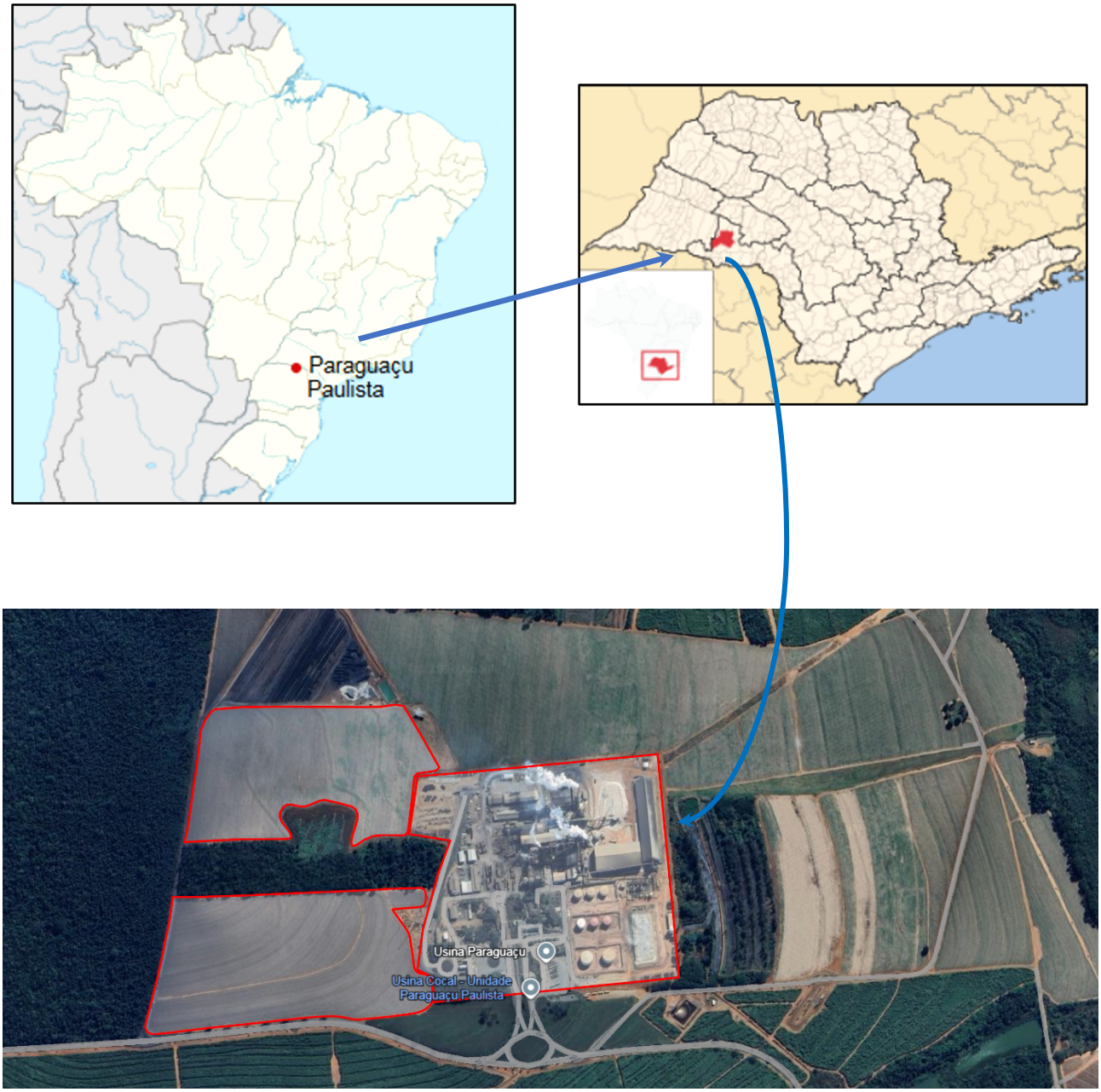
A.3. Location of project activity >>

Country: Brazil
District: Paraguaçu Paulista
State: São Paulo
Zip Code: 19.729-899

Latitude: 22.5067° S
Longitude: 50.8653° W



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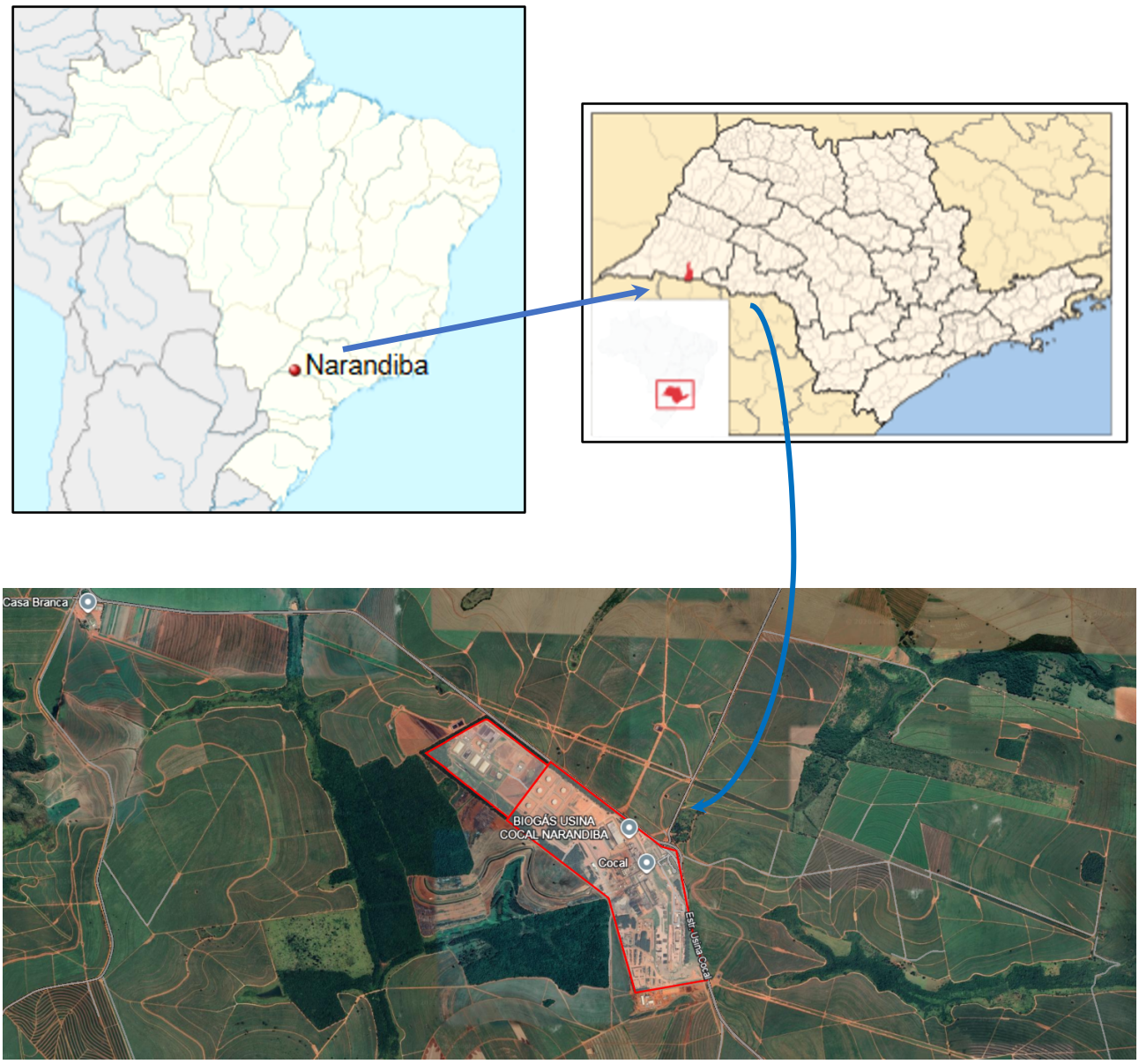
Country: Brazil
District: Narandiba
State: São Paulo
Zip Code: 19.220-000

Latitude: 22.407º S
Longitude: 51.524º W



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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 of generating 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

1) Photographs of the Cocal Paraguaçu Paulista (PPT) Sugarcane Mill



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Electrical Systems



Substations

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Reforested Eucalyptus Wood - For boiler ignition at the start of the harvest season



Stockpile of sugarcane bagasse





Ashes from bagasse combustion are returned to the sugarcane plantation as fertilizer

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Generator 3 – 25 MW



Generator 3 – 25 MW



Generator 3 – 25 MW



Turbine UG3

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Boiler nº 5



Boiler nº 6

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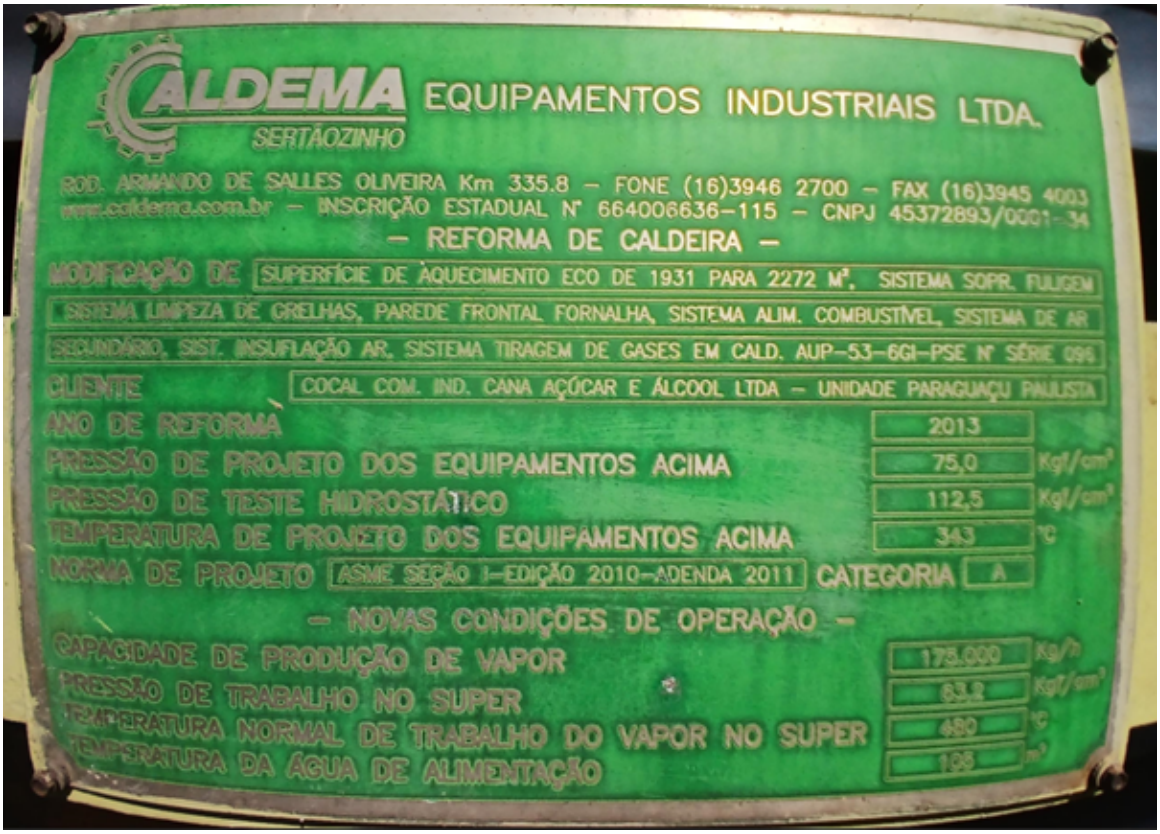
The system consists of one power-generating unit supplied by two boilers:

Boiler	**Nº 05**	**Nº 06**
Manufacturer	CALDEMA	HPB
Capacity (Tons/h)	175	200
Serial number	Not available	5200 / 1
Year of manufacture and/or refurbishment	2013	2012
Maximum allowable working pressure (kgf/cm^{2}g)	83.2	74.5
Hydrostatic Test Pressure (kgf/cm^{2}g)	112.5	111.8
Pressure (kgf/cm^2)	75	62
Degree of super heat ºC (Steam)	480	490
Heating surface area (m^2)	Not available	3,491
Design Standard	ASME I -2010 / 2011	ASME I -2010 / 2011
category	A	A



Nameplate data Boiler nº 5

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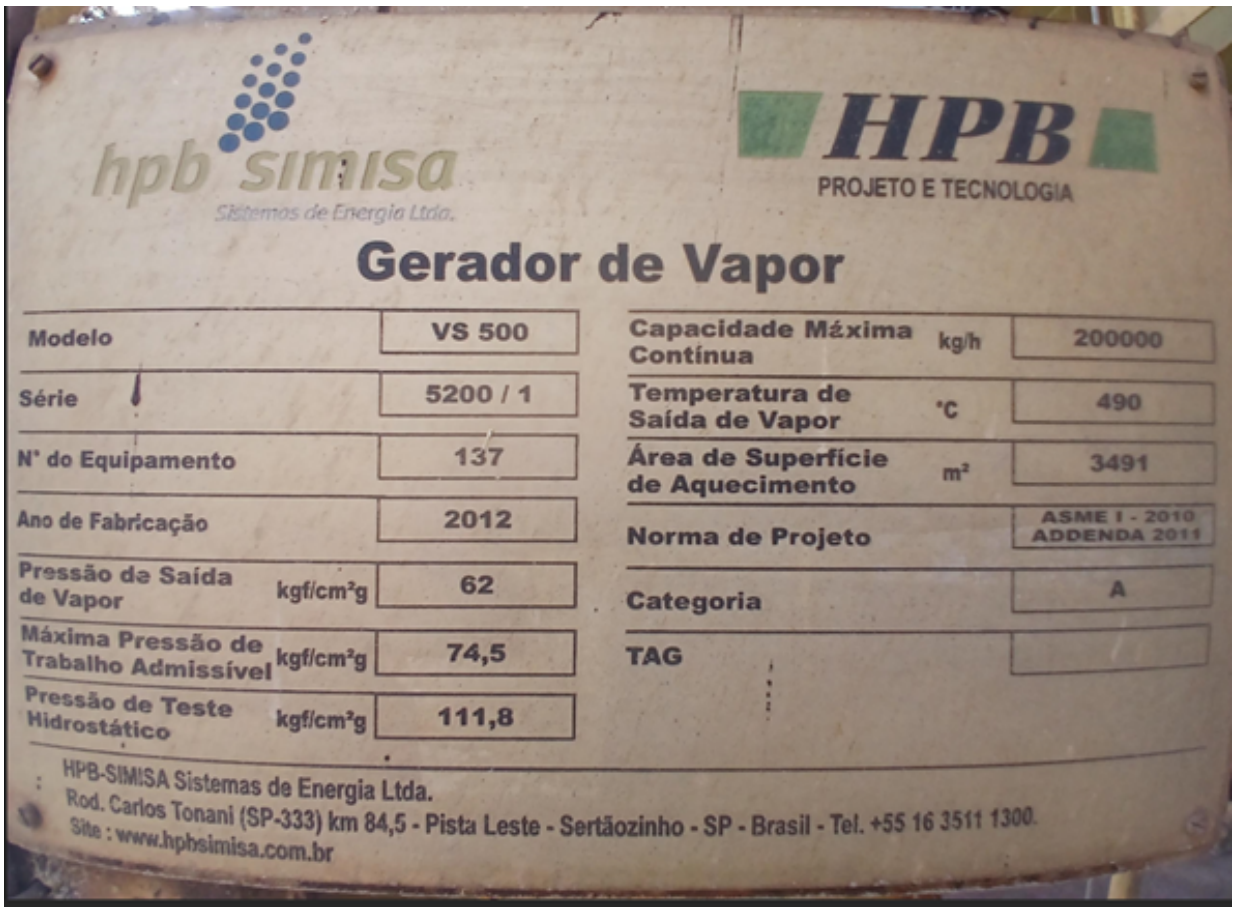

Nameplate data Boiler nº 6

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Alternator/ Generator	Nº 3
Year of manufacture	1965
Manufacturer	GEVISA
Power Rated (kVA)	31,250
Serial Number	NS TSH 227001218
Voltage (V)	13,800
Current (Amps)	1,307
Power Factor (cos φ)	0.80
Generator Rated Speed (rpm)	1,800
Frequency (Hz)	60
Generator Model	271R441



1. Dados do equipamento:

Gerador Síncrono			
Fabricante:	GEVISA	Potência:	31250 KVA
Nº de Série:	NS TSH 227001218	Modelo:	271R441
Ligação:	Y	Classe Isol.:	F
Rotação:	1800	Nº de Polos:	4
Fator de Serviço:	1	Frequência:	60 Hz
Tensão	13800 v	Corrente:	1307 A
Fator de Potência:	0,80	Rendimento:	0,98
Tensão Excitação:	62,5 V	Corrente excitação:	4,5 A
Ano Fabricação:	1965	Cos φ	0,8

Nameplate data Alternator/ Generator nº 3

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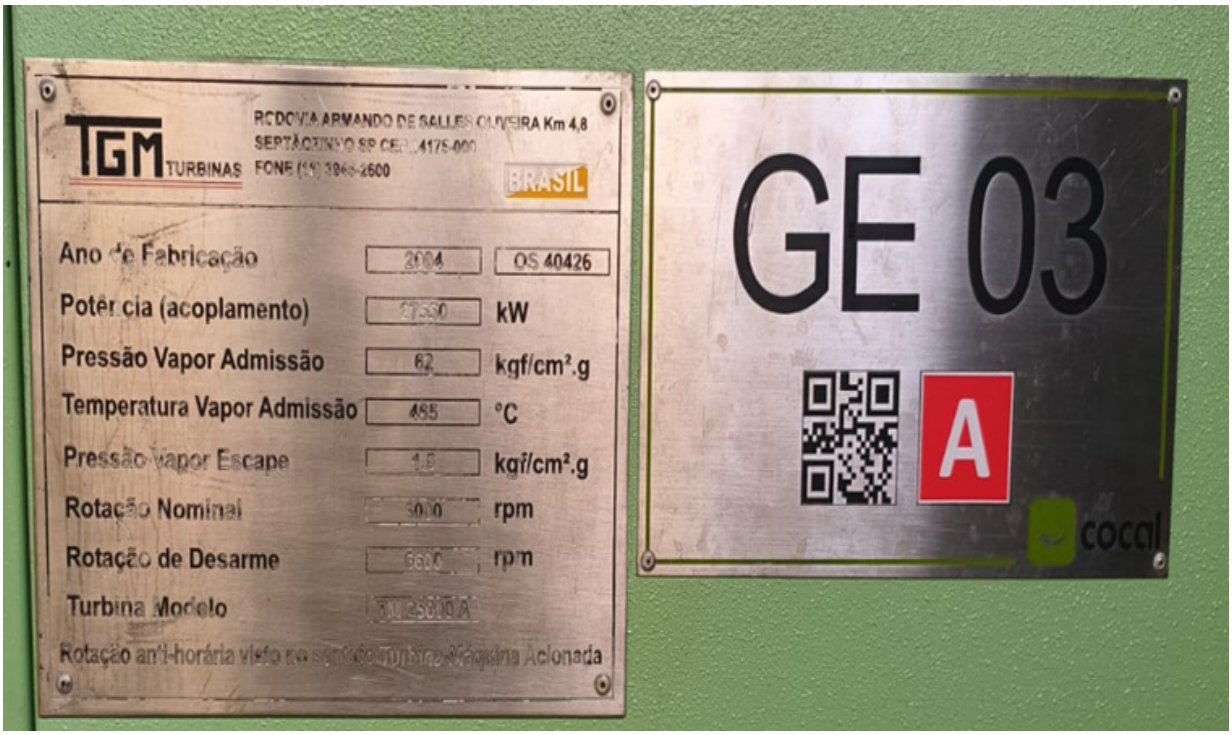
Turbine	Nº 3
Year of manufacturer	2004
Manufacturer	TGM Turbinas
Power Rated (kW)	27,550
Live Steam Pressure (Bar)	62
Live Steam Temperature (ºC)	565
Steam Exhaust Pressure (Bar)	1.5
Turbine Rated Speed (rpm)	6,000
Turbine Disarm Speed (rpm)	6,600
Turbine Model	TM 25000A



Nameplate data Turbine nº 3

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2) Photographs of the Cocal II Narandiba (NRD) Sugarcane Mill



Thermal Generation Center





Sugarcane milling equipment

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Steam transport for the industrial process



Steam condenser



Steam transport

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Sugarcane bagasse stock



Biogas plant

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Electrical Systems

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Substations

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Generator 1 – 40 MW



Generator 2 – 40 MW

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Generator 3 – 51.3 MW



Boiler 1



Boiler 2

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The system consists of three power-generating units supplied by two boilers:

Boiler	Nº 01	Nº 02
Manufacturer	CALDEMA	HPB
Capacity (Tons/h)	350	250
Serial number	117 / 2008	5250 / 1
Year of manufacturer	2008	2012
Maximum allowable working pressure (kgf/cm^{2}g)	80	79.6
Hydrostatic Test Pressure (kgf/cm^{2}g)	120	119.7
Pressure (kgf/cm^2)	67	67
Degree of super heat ºC (Steam)	530	530
Heating surface area (m^2)	1,130	3,974
Design Standard	ASME I -2007	ASME I -2010
category	A	A



Nameplate data Boiler nº 1



Nameplate data Boiler nº 2

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Alternator/ Generator	Nº 1	Nº 2	Nº 3
Year of manufacturer	2007	2009	2014
Manufacturer	WEG	WEG	Siemens
Power Rated (kVA)	50,000	50,000	62,000
Serial Number	162825	1004488507	30460388
Voltage (V)	13,800	13,800	13,800
Current (Amps)	2,092	2,092	2,594
Power Factor (cos φ)	0.80	0.80	0.83
Generator Rated Speed (rpm)	1,800	1,800	1,800
Frequency (Hz)	60	60	60
Generator Model	SPW 1250	SPW 1250	SGEN 6-100A-4P



Nameplate data Alternator/ Generator nº 1

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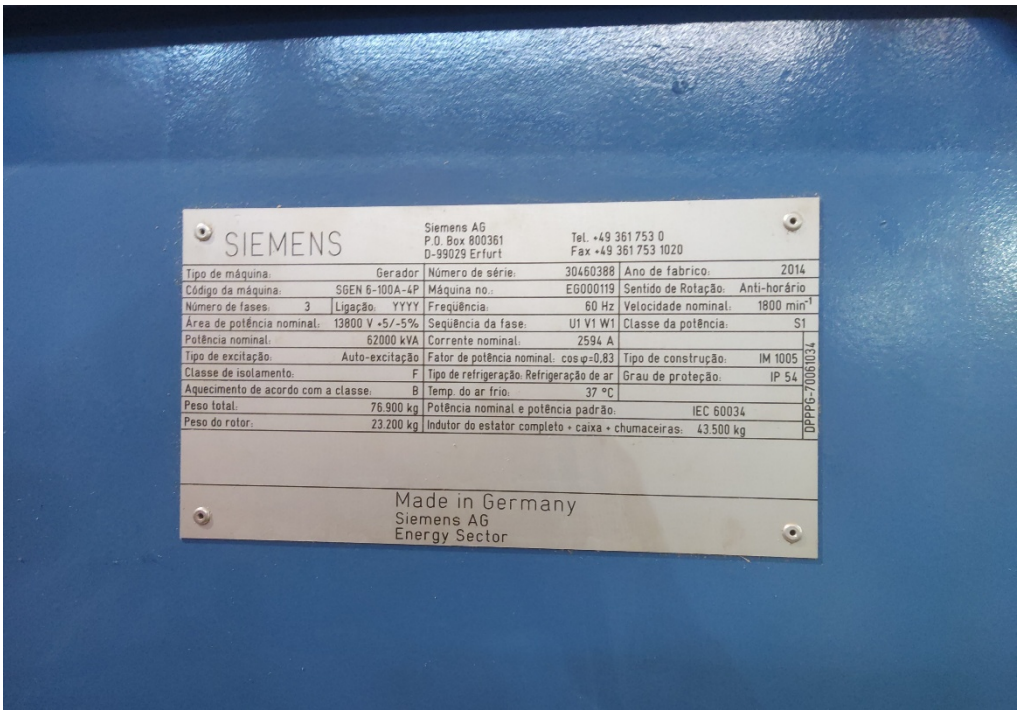
Nameplate data Alternator/ Generator nº 2



Nameplate data Alternator/ Generator nº 3

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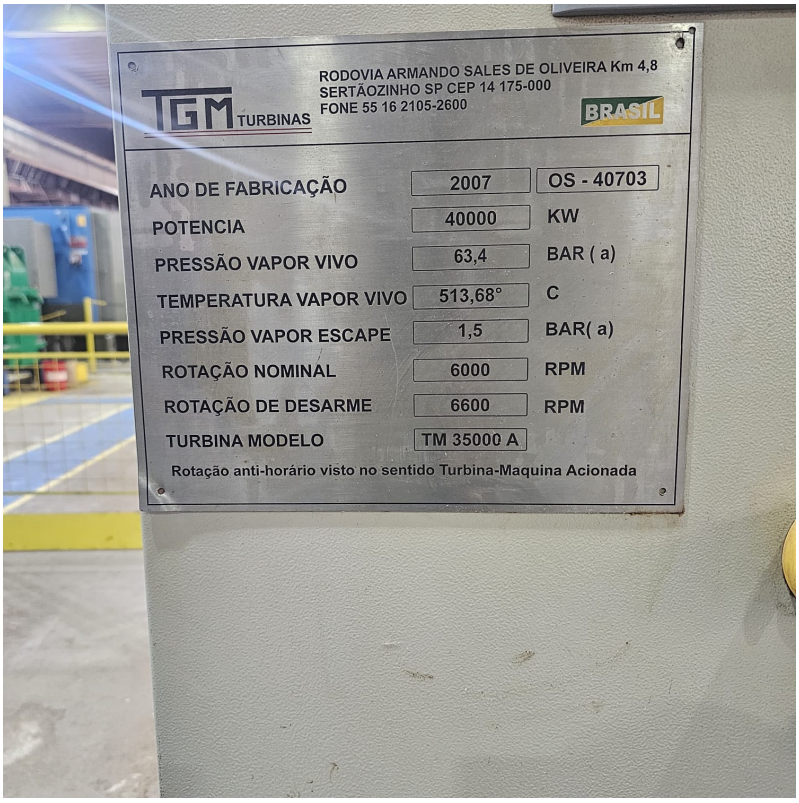
Turbine	Nº 1	Nº 2	Nº 3
Year of manufacturer	2007	2010	2013
Manufacturer	TGM Turbinas	WEG	Siemens
Power Rated (kW)	40,000	41,360	51,300
Live Steam Pressure (Bar)	63.4	63.17	65
Live Steam Temperature (ºC)	513.68	513.21	525
Steam Exhaust Pressure (Bar)	1.5	2.48	2.5
Turbine Rated Speed (rpm)	6,000	6,000	5,297
Turbine Disarm Speed (rpm)	6,600	6,600	5,827
Turbine Model	TM 35000A	TM 35000A	SST-600



Nameplate data Turbine nº 1

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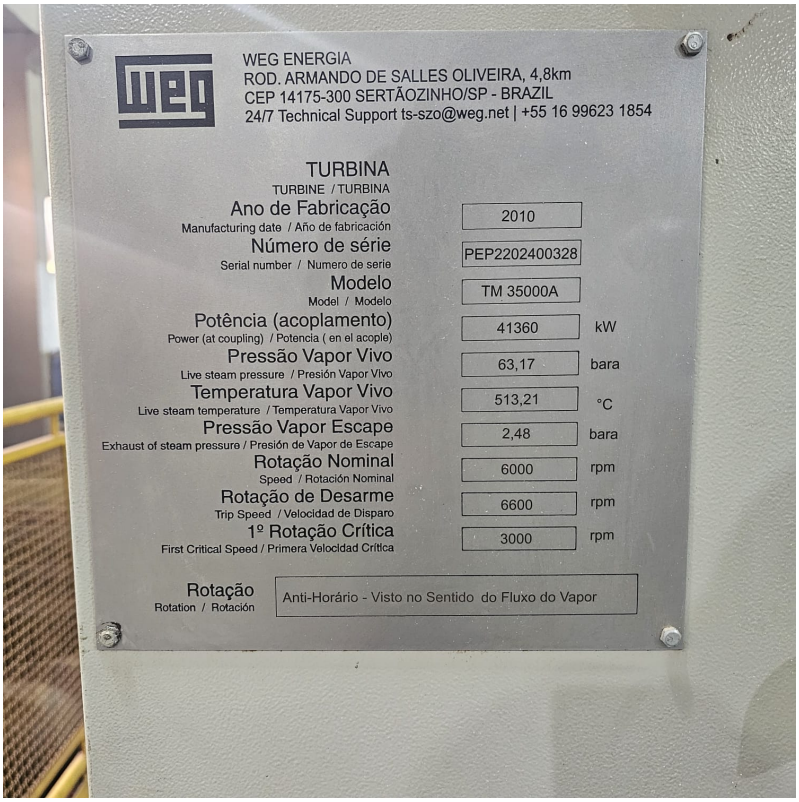
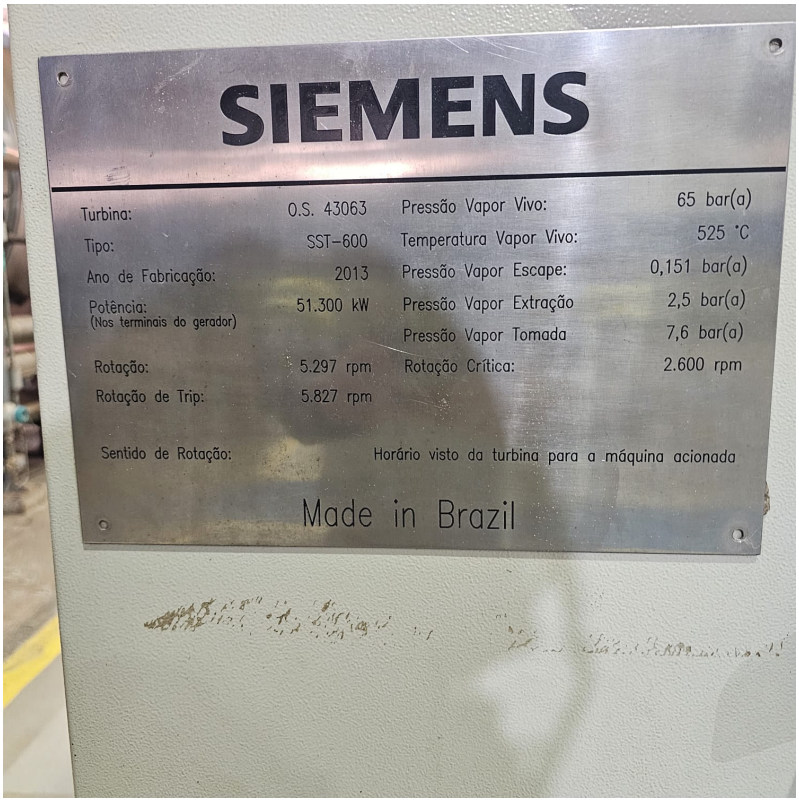


Nameplate data Turbine nº 2



Nameplate data Turbine nº 3

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A.5. Parties and project participants >>

Party (Host)	Participants
Brazil	**Owner:** COCAL TERMOELÉTRICA S/A Parque Industrial Dr. Camilo Calazans de Magalhães, s/nº, São Matheus, Paraguaçu Paulista – SP Zip Code: 19.729-899 https://www.cocal.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

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A.6. Baseline Emissions>>

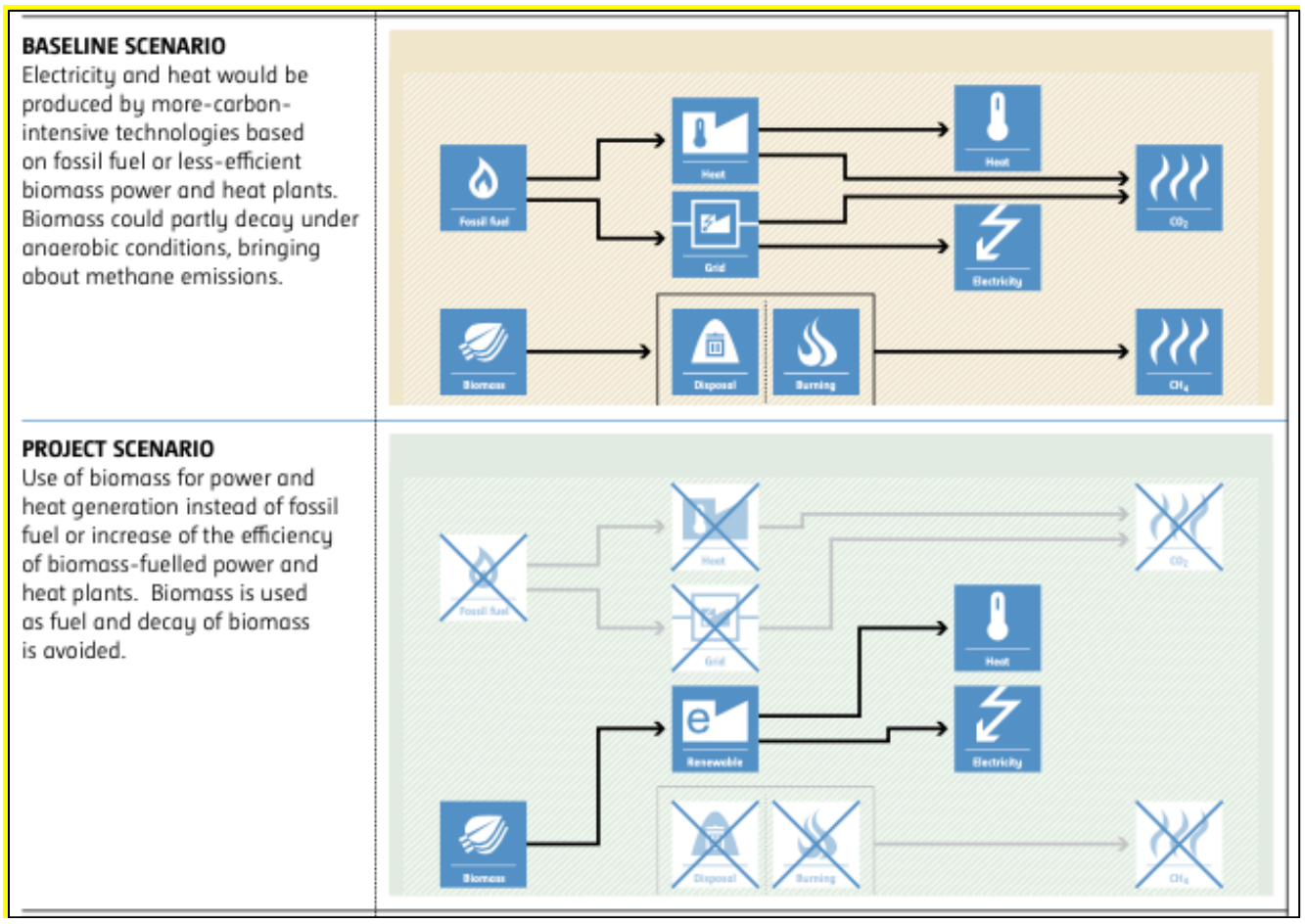
The baseline scenario identified in this Project Concept Report (PCN) of the project activity is:

The approved baseline methodology applied is ACM0006 (Version 16.0), 'Electricity and heat generation from biomass' and monitoring methodologies for selected large scale UNFCCC CDM project activities that involve generation of power and heat in thermal power plants, including cogeneration plants using biomass.

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

The electricity supplied to the grid by COCAL TERMOELÉTRICA S/A (project activity) would have otherwise been generated by fossil-fuel-fed power plants connected to the national grid, which are carbon intensive sources of electricity generation.

ACM0006 Electricity and heat generation from biomass



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A.7. Debundling>>

This "156.3 MW Sugarcane-Bagasse-Based Cogeneration Energy Project – COCAL TERMOELÉTRICA S/A" 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.

A.8. Additionality of the project activity>>

A.8.1. Purpose and voluntary nature of this assessment

Although the UCR carbon incentive model does not require a demonstration of additionality — the project activity qualifies under the environmental additional positive list of pre-approved project types — this Section A.8 is voluntarily included in the Project Concept Note to provide a full and transparent additionality assessment. The objective is to provide third-party carbon credit rating agencies and potential credit purchasers with robust evidence that the emission reductions claimed by the project activity would not occur in the absence of the revenue from Carbon Offset Units (CoUs).

The assessment follows, to the extent applicable, the general structure of the CDM "Tool for the demonstration and assessment of additionality" (Version 07.0.0) and is consistent with the additionality framework applied under others carbon credits programs, as adopted in the additionality analysis of comparable grid-connected renewable energy projects used as internal reference. The assessment comprises:

(i) identification of alternatives to the project activity consistent with current laws and regulations, including the legal requirement test;
(ii) prior consideration of the project activity;
(iii) investment analysis;
(iv) barrier analysis; and
(v) common practice analysis.

A.8.2. Declared deviation from the CDM temporal requirement and its justification

The investment analysis presented in Section A.8.5 was conducted using current market data, treating the project as an investment decision evaluated today and projecting the financial returns over a ten-year horizon. It is expressly declared that this approach deviates from the temporal requirement of the CDM Tool 01, which determines that the investment analysis be based on the parameters prevailing at the time of the original investment decision.

This deviation is justified on the following grounds:

The UCR carbon incentive model does not require additionality demonstration; this assessment is voluntary and its purpose is to inform third-party rating and due diligence processes, which evaluate the present economic viability of projects rather than historical decision-making.

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The crediting period of this project activity is retroactive (starting on January 1, 2013). A faithful reconstruction of the economic parameters prevailing at the original investment decisions (2001 for UTE 1 and 2008 to 2014 for UTE 2, including historical tariffs, capital costs, and debt conditions) would rely on assumptions of low verifiable reliability. The analysis based on current, real and verifiable data is the only one that can be substantiated with documentary evidence.

The current-data approach is more conservative: testing viability under present market conditions is more demanding than testing under potentially more favourable historical conditions. If the project fails the investment benchmark today without CoU revenue, it would a fortiori have failed it under comparable conditions at the time of the original decisions.

The approach is consistent with established practice in the re-demonstration of additionality upon renewal of crediting periods under international carbon standards, where current data replace historical parameters.

The historical operation of the project without carbon revenue does not contradict this assessment, as the analysed scenario is not the continuation of existing sunk assets, but a hypothetical new incremental investment decision evaluated at current replacement costs and current electricity prices, which are materially different from those prevailing at the time of the original decisions.

A.8.3. Prior consideration of the project activity

The regulatory timeline documented in Section A.1 demonstrates that the decisions to implement and expand the project activity were taken and executed years before any reasonable expectation of revenue from carbon markets.

It is further emphasized that the original investment decision was taken in 2001, in the midst of one of the most severe energy supply crises in Brazilian history, which led to nationwide electricity rationing between 2001 and 2002. In this context, the decision to invest in renewable biomass-based electricity generation was a strategic contribution to the security and diversification of the Brazilian energy matrix, undertaken at a time when carbon markets were nascent and generated no revenue expectation for the project. At the time of all investment decisions (2001, 2008, 2010 and 2014), carbon credit revenue was not a determinant factor of the investment decision.

A.8.4. Step 1 — Identification of alternatives to the project activity consistent with current laws and regulations

The following alternatives to the project activity were identified, all of them consistent with current laws and regulations of Brazil:

Alternative 1 — The project activity as proposed: operation of high-pressure bagasse-fired cogeneration with export of surplus electricity to the national interconnected grid, requiring the incremental investment described in Section A.8.5.

Alternative 2 — Cogeneration for self-consumption only: operation of the cogeneration facilities exclusively to supply the thermal and electrical demand of the industrial complex, without any export of electricity to the grid. This alternative would not require the incremental investment in high-pressure boiler configuration, powerhouse and substation for grid connection, and was technically and legally feasible.

Alternative 3 — Allocation of the same capital to alternative uses within the industrial complex: the capital employed in the incremental export-oriented investment could have been applied to other strategic uses of the sugar-energy operation, such as the expansion of ethanol production capacity, the development of second-generation (2G) ethanol, or other industrial process investments.

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Alternative 4 — Continuation of the current situation without the incremental investment: no expansion of generation capacity beyond self-consumption needs.

Legal requirement test.

Brazilian legislation does not require sugar-energy producers to generate renewable electricity, to expand generation capacity, or to export electricity to the national grid. The ANEEL authorizations and the CUSD documented in Section A.1 are permissions that enable the export of electricity, not legal obligations.

Likewise, there is no federal or state legal requirement imposing renewable electricity generation on the industrial sector. All four alternatives identified above are therefore fully compliant with applicable laws and regulations, and the project activity is not being implemented to comply with any legal mandate. The project activity passes the legal requirement test.

A.8.5. Step 2 – Investment analysis

The investment analysis evaluates the financial viability of a new investment decision made today, under the reference conditions of the UTE Cocal II – Narandiba (NRD) unit. The same analytical framework is directly replicable to the UTE 1 – Paraguaçu Paulista (PPT) unit, whose parameters are of the same order of magnitude; the consolidated conclusions apply to the project activity as a whole.

Nature of the assessed investment. The CAPEX assessed in this analysis represents the incremental investment specifically associated with the decision to export electricity to the grid. It corresponds to the difference between a low-pressure boiler configuration, which would be sufficient to supply the self-consumption demand of the industrial complex, and the high-pressure boiler configuration actually adopted, plus the powerhouse and substation infrastructure required to connect the plant to the national grid. This framing is decisive for the additionality assessment: Cocal could simply have opted to generate electricity for its own consumption only, without exporting, and to allocate the same capital to alternative uses such as second-generation ethanol or the expansion of ethanol production. The decision to incur this incremental investment was made specifically to export renewable electricity to the grid.

The benchmark used for the investment decision is the weighted average cost of capital (WACC) of the project. The WACC is the average rate of return required by the providers of capital to the project, calculated as the cost of equity multiplied by the proportion of equity in the capital structure, plus the after-tax cost of debt multiplied by the proportion of debt in the capital structure.

The WACC is estimated using the standard financial cost of capital formula:

$$WACC = r_e \times W_e + r_d \times W_d \times (1 - T_c)$$

Where:

r_e = Cost of equity

W_e = Percentage of financing that is equity

r_d = Cost of debt

W_d = Proportion of equity in the capital structure

T_c = Proportion of debt in the capital structure

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Calculation Steps:

$\mathbf{r_e}$ was obtained from Table 1 of the Appendix of CDM Tool 27 version 14.0. A value of **10.37%** was used and represents the default values for the cost of equity for Group 1 (Energy Industries) in Brazil, in real terms.
As the Project IRR is calculated in nominal terms, this value was revised to account for inflation, as per Fisher Equation (https://en.wikipedia.org/wiki/Fisher_equation), demonstrated below:

Nominal Cost of Equity (r_e):

$$\mathbf{r_{e,nominal} = (1 + r_{e,real}) \times (1 - i) - 1}$$

Where:

$\mathbf{r_{e,real}}$ = 10.37% (from Table 1 of the Appendix of CDM Tool 27 version 14.0)

$\boldsymbol{i}$ = 3.50% p.a. (Inflation Rate Parameter, Data Source & Reference Link: Central Bank of Brazil (BACEN) — Inflation Target Framework (https://www.bcb.gov.br/en/monetarypolicy/inflationtarget)

$r_{e,nominal} = (1 + 10.37\%) \times (1 + 3.50\%) - 1 = 14.23\%$ p.a.

The project adopts a capital structure composed of **36%** Equity ($\mathbf{W_e}$) and **64%** Debt ($\mathbf{W_d}$). Rather than using generic sector averages or the default 50%/50% split provided by the methodology, these figures directly reflect the actual operational financial structure practiced by Usina Cocal. Adopting company-specific financial parameters is fully compliant with paragraph 26/27 of CDM TOOL27 (v14.0), ensuring that the investment analysis accurately mirrors the real-world corporate decision-making context and financing conditions of the project developer.

According to paragraph 25 of CDM TOOL27 (v14.0), when market-standard benchmarks are applied, the cost of debt must reflect the actual cost of commercial borrowing for comparable projects in the host country. The adopted rate combines the official sovereign benchmark rate (Selic) with a standard 1.00% p.a. credit risk spread, representing realistic market lending conditions for corporate energy and infrastructure project finance in Brazil. Target Selic Rate (13.75% p.a.) plus Commercial Bank Risk Spread (1.00% p.a.).

- **Selic Rate:** Central Bank of Brazil (BACEN) — Monetary Policy Decisions (https://www.bcb.gov.br/en/monetarypolicy/copomdecisions).

- **Commercial Credit Spread Data:** Central Bank of Brazil (BACEN) — Banking Economy Report / Credit Indicators (https://www.bcb.gov.br/en/publications/bankingeconomyreport).

Therefore, the final nominal cost of debt (r_d) for the project is established as:

r_d = 13.75% (Selic Target Rate) + 1.00% (Commercial Bank Risk Spread) = 14.75% p.a.

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Presumed profit is a tax regime to determine how taxes will be calculated and paid, where the company does not need to determine its actual profit, but estimate it based on a pre-defined percentage of gross revenue.
In the presumed profit, what is paid in debt will not be deducted from the profit for calculation of taxes, as it is presumed as a value defined by legislation, so there is no tax deduction under the effect of the debt.
As a presumed profit was adopted for the investment analysis, the Corporate Tax Rate (T_c) was considered zero in the WACC calculation. The tax regime was selected according to Law 9.718/1998 (https://www.planalto.gov.br/ccivil_03/leis/l9718compilada.htm).

Therefore,

$$WACC = r_e \text{ x } W_e + r_d \text{ x } W_d \text{ x } (1 - T_c)$$

$$WACC = 14.23\% \text{ x } 36\% + 14.75\% \text{ x } 64\% \text{ x } (1 - 0)$$

WACC = 14.56%

WACC Result (Financial Benchmark):

WACC = 14.56%

For this analysis, a nominal WACC of 14.56 percent was adopted.

The net present value (NPV) is obtained by discounting each annual free cash flow of the project at the WACC and subtracting the initial CAPEX.

The internal rate of return (IRR) is the discount rate at which the NPV equals zero, that is, the rate at which the sum of the discounted future cash flows exactly equals the initial investment.

A project is economically viable and attractive to investors only if the IRR exceeds the WACC, or equivalently, if the NPV is positive.

All monetary values in this Section are expressed in United States dollars, converted at the exchange rate of R$ 5.20 per US$ 1.00. Two scenarios were assessed, both with the same **incremental CAPEX of US$ 12.5 million** (R$ 65.0 million converted at the exchange rate adopted for this analysis), reflecting the current replacement value of the incremental export-oriented assets at present prices:

To ensure full transparency and auditability, the step-by-step financial models and IRR calculations for both Scenario 1 and Scenario 2 are presented below and are made fully accessible to the Verifier within the provided unprotected electronic spreadsheet.

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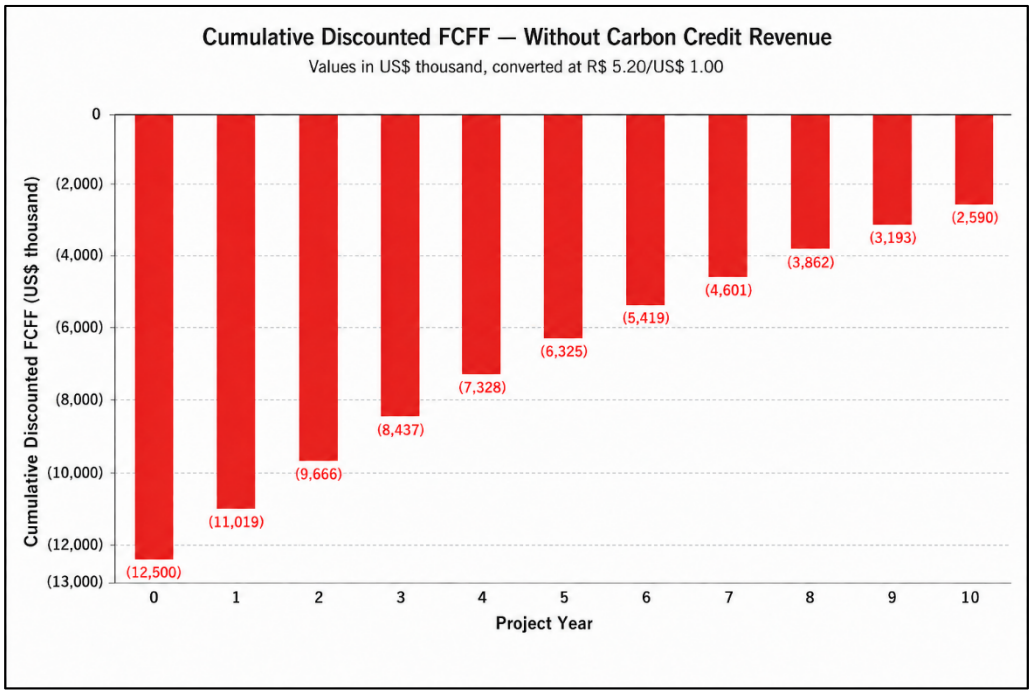
Scenario I — Without carbon credit revenue. The project generates revenue exclusively from the sale of electricity to the grid.

$$\mathbf{IRR_{Scenario\ I} = 9.23\%}$$

Results:

Project Vision	Unit	Values
CAPEX	US$ thousands	12,500
WACC - Nominal	%	14.56%
Simple Payback	years	6.6
Discounted Payback	years	N/A
IRR	%	9.23%
NPV	US$ thousands	-2,590

- IRR of 9.23 percent, below the WACC of 14.56 percent;
- NPV of negative US$ 2,590 thousands;
- Simple payback of 6.6 years;
- Discounted payback not achieved within the projection horizon.
- Under this scenario, the project destroys economic value and would not attract investment: the discounted cash flows do not recover the initial investment.
-



Cumulative Discounted Free Cash Flow to the Firm – Without Carbon Credit Revenue

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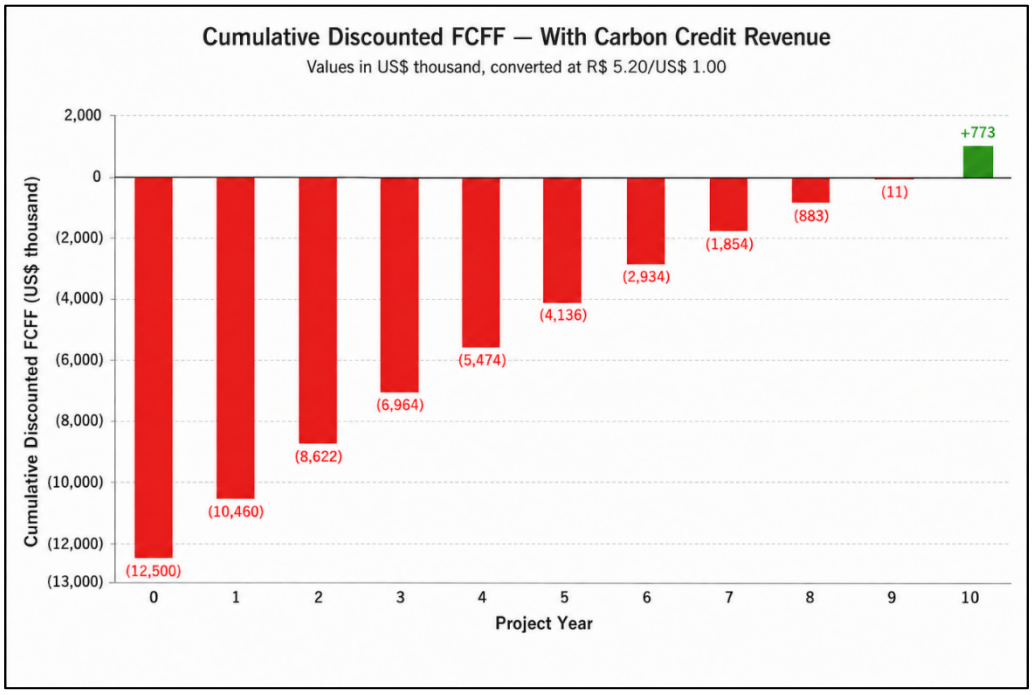
Scenario II — With carbon credit revenue. The project adds the revenue from the issuance and sale of CoUs, at the estimated volume of 67,446 CoUs per year

$$\mathbf{IRR_{Scenario\ II} = 16.07\%}$$

Results:

Project Vision	Unit	Values
CAPEX	US$ thousands	12,500
WACC - Nominal	%	14.56%
Simple Payback	years	5,0
Discounted Payback	years	9.0
IRR	%	16.07%
NPV	US$ thousands	772.7

- IRR of 16.07 percent, above the WACC of 14.56 percent;
- NPV of positive US$ 772.7 thousands;
- Simple payback of 5.0 years;
- Discounted payback of 9.0 years.
- In this scenario, the project becomes viable, at the limit of acceptability.



Cumulative Discounted Free Cash Flow to the Firm – With Carbon Credit Revenue

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The difference of 6.19 percentage points in IRR between the two scenarios demonstrates quantitatively that the revenue from carbon credits is decisive for the economic viability of the incremental export-oriented investment. Without CoU revenue, the project does not cover its cost of capital and is not bankable; with CoU revenue, the project generates positive value for its investors.

Sub-step 2d – Sensitivity — breakeven carbon revenue

For the NPV to move from negative US$ 2.59 million to zero, an incremental present revenue of approximately US$ 2.6 million over ten years is required, equivalent to an annual carbon revenue of approximately US$ 0.5 million, or approximately US$ 7.5 per CoU at the issuance volume of 67,446 CoUs per year. This breakeven price is consistent with prevailing price levels in the voluntary carbon market, confirming that the carbon revenue is neither hypothetical nor marginal, but the variable that determines the investment decision.

A.8.6. Step 3 – Barrier analysis

In addition to the investment barrier demonstrated above, the project activity faces the following non-trivial barriers, which would prevent its implementation in the absence of CoU revenue:

- **Absence of legal obligation combined with grid access barrier:** Brazilian law does not require renewable electricity generation or grid export, and the export decision depends on Distribution System Use Contracts (CUSD) and ANEEL authorizations, subject to administrative timelines and network-connection costs that materially affect the project economics, as documented in Section A.1.
- **Opportunity cost of capital barrier:** the capital employed in the incremental export-oriented investment competes with alternative strategic uses within the industrial complex, such as second-generation ethanol and the expansion of ethanol production capacity, which represent the company's core business. In the absence of carbon revenue, allocating capital to grid export is economically inferior to these alternatives.
- **Technological and operational barrier:** at the time of the original investment decisions, the high-pressure and high-temperature boiler configuration required for efficient electricity export (in the range of 65 to 90 bar) was a technological frontier application in the Brazilian sugar-energy sector, where most mills operated low or medium-pressure boilers for self-consumption only. There was no consolidated performance track record for export-oriented bagasse cogeneration at that scale, and the sector-wide diffusion of high-pressure technology only materialized in subsequent years. The sequential expansions of UTE 2 (UG1 in 2010, UG2 in 2010 and UG3 in 2014) required the integration of new boilers, turbines and generators into an existing industrial cogeneration complex, with associated execution risk and commissioning downtime.
- **Price volatility barrier:** a significant share of the exported energy is exposed to spot market price volatility in the Brazilian electricity sector, increasing revenue uncertainty for a capital-intensive asset.

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- **Strategic temporal contribution to grid stability:** bagasse availability is concentrated in the sugarcane harvest season, which corresponds exactly to the dry season of the Center-South region of Brazil (April to November). During this period, hydroelectric reservoir levels reach their lowest annual values, thermal plants with higher marginal costs are dispatched, and higher tariff flag levels (yellow and red flags) signal system stress conditions. The project activity therefore exports renewable electricity precisely at the time of the year when the Brazilian electrical system faces its greatest scarcity and when marginal generation is predominantly fossil-based, maximizing both the system value of the exported energy and its contribution to the stability and security of the national interconnected grid.

A.8.7. Step 4 – Common practice analysis

Bagasse cogeneration for self-consumption is a consolidated practice in the Brazilian sugar-energy sector. However, the relevant comparison for this project is not the existence of cogeneration in the sector, but the specific investment decision to implement high-pressure cogeneration with significant export of surplus electricity to the grid. At the time of the original investment decision (2001 to 2002), this configuration was not common practice: the diffusion of high-pressure boiler technology in the Brazilian sugar-energy sector only consolidated in the mid-2000s and 2010s, the regulatory framework enabling power sales by self-producers had only recently been established (Laws No 9,074 of 1995 and No 9,433 of 1997), the 2001-2002 energy crisis had just opened the commercial opportunity, and the CDM methodology ACM0002 for grid-connected cogeneration was only formalized from 2003 onwards, meaning there was no established track record of comparable projects at the time of the investment decision. The incremental units UG2 (40 MW, 2010) and UG3 (51.3 MW, 2014) were implemented at moments of specific regulatory and market conditions, and their economic viability today, as demonstrated in Section A.8.5, depends on carbon revenue. The demonstration that the incremental export-oriented investment is not economically attractive without CoU revenue, applied to a decision evaluated under current conditions, is sufficient to conclude that the project activity is not common practice in the sense relevant for this assessment.

A.8.8. Conclusion

The project activity is additional. It is not mandated by any legal requirement, and all identified alternatives — self-consumption only, alternative use of capital in ethanol production, or no incremental investment — are legally feasible and economically superior in the absence of carbon revenue. Without the revenue from Carbon Offset Units, the incremental export-oriented investment presents an IRR of 9.23 percent, below the weighted average cost of capital of 13.57 percent, with a negative NPV of US$ 2.2 million and no discounted payback within the projection horizon — conditions under which no rational investor would proceed with the investment, preferring instead to allocate capital to the core ethanol business or to restrict generation to self-consumption. The carbon revenue elevates the IRR to 15.42 percent, above the cost of capital, with a positive NPV of US$ 1.0 million. The emission reductions of 67,446 tCO2 equivalent per year claimed by the project activity are therefore a direct result of the carbon incentive and would not occur in its absence in the manner and at the scale claimed.

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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.

Applicability Criteria	Applicability status
This methodology is applicable to project activities that operate biomass (co-)fired power-and-heat plants. The CDM project activity may include the following activities or, where applicable, combinations of these activities: (a) The installation of new plants at a site where currently no power or heat generation occurs (Greenfield projects); (b) The installation of new plants at a site where currently power or heat generation occurs. The new plant replaces or is operated next to existing plants (capacity expansion projects); (c) The improvement of energy efficiency of existing biomass-based power-and-heat plants (energy efficiency improvement projects), which can also lead to a capacity expansion, e.g. by retrofitting the existing plant; (d) The total or partial replacement of fossil fuels by biomass in existing power-and-heat plants or in new power-and-heat plants that would have been built in the absence of the project (fuel switch projects), e.g. by increasing the share of biomass use as compared to the baseline, by retrofitting an existing plant to use biomass.	The project activity is a power generation project using biomass, specifically sugarcane 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 criterion of the methodology.

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Project Type Electricity and heat generation from biomass (new plants, capacity expansions, energy efficiency improvements, or fuel switch projects)	Cogeneration project generating electricity from sugarcane bagasse with two units
Biomass Type Biomass residues from production processes (not from dedicated plantations). Examples: bagasse, straw, forest residues.	Sugarcane bagasse (residue from juice extraction process for ethanol and sugar production). Eucalyptus wood used only for boiler ignition (annually). Both are renewable biomass, not from dedicated plantations.
Biomass Storage Biomass not stored for more than one year. Cannot be processed chemically or biologically prior to combustion.	The biomass used by the project plant is not stored for more than one year. The biomass used by the project plant is not processed chemically or biologically (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio-or chemical degradation, etc.) prior to combustion.
Fossil Fuel Co-firing Project does not co-fire fossil fuels OR does not exceed 25% fossil fuel co-firing (per UCR Protocol).	No fossil fuels (diesel, coal, natural gas) used. Only sugarcane bagasse and reforested eucalyptus wood (both renewable). Zero fossil fuel co-firing.
Installed Capacity Methodology applicable to large-scale plants (>25 MW for biomass).	The project activity is a power plant that encompasses cogeneration plants, i.e. power plant in which at least one heat engine simultaneously generates both process heat and power. The total installed capacity of project activity is 156.3 MW which is acceptable as per the applied large-scale methodology.
Grid Connection Project must be connected to national or regional electricity grid for electricity export.	Both units (NRD and PPT) are connected to Brazilian national electricity grid. Generation data obtained via CCEE (Electric Energy Trading Chamber). ANEEL authorization for commercial operation confirmed.

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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 that have 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.

COCAL TERMOELÉTRICA S/A 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 is 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.

Cocal holds two distinct certifications under the International Sustainability and Carbon Certification (ISCC) framework:

ISCC PLUS is a voluntary, globally recognized sustainability standard applicable to biomass, biofuels, and bio-based products outside the scope of the EU Renewable Energy Directive. For Cocal, this certification covers the production chain of sugar, ethanol, and sugarcane byproducts — including bagasse, vinasse, dry yeast, and food-grade CO_2 — at both the Paraguaçu Paulista and Narandiba units. ISCC PLUS ensures compliance with strict sustainability criteria, including deforestation-free sourcing, traceability, waste management, greenhouse gas (GHG) accounting, and social responsibility standards. The certification facilitates access to international markets that demand high environmental and social performance.

ISCC CORSIA PLUS, obtained during the 2024/2025 harvest year for both industrial units, is a certification specifically designed under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), administered by the International Civil Aviation Organization (ICAO). This certification attests that Cocal's ethanol meets the CORSIA sustainability criteria for CORSIA-eligible fuels (CEF), including lifecycle GHG emissions reduction thresholds and the assurance that no biomass originates from high-carbon-stock or protected lands. ISCC CORSIA PLUS certification enables Cocal's ethanol to be used as a feedstock for the production of Sustainable Aviation Fuel (SAF), which, when uplifted by airlines, reduces their offsetting obligations under the CORSIA framework.

Important Clarification on CORSIA Credits: It should be noted that Cocal does not generate, issue, or retire CORSIA carbon offset credits. The ISCC CORSIA PLUS certification confirms that the ethanol produced meets the sustainability and lifecycle emissions criteria required for use as a SAF feedstock. The environmental benefit — i.e., the reduction in CORSIA offsetting obligations — is claimed by the airline operator that purchases and consumes the SAF produced from Cocal's certified

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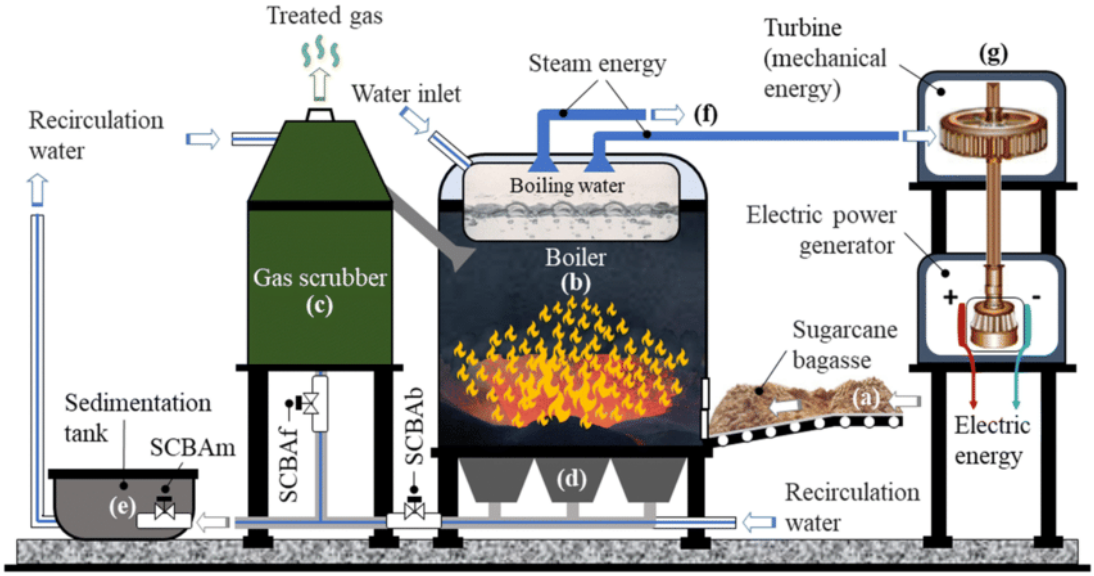
ethanol. The chain of custody is tracked through the ISCC Credit Transfer System (CTS), which follows sustainability declarations from the feedstock producer (Cocal) through the SAF refiner to the airport delivery point.

Relationship with the CoU Project Activity: The scope of this Carbon Offset Unit (CoU) project activity is limited to the renewable electricity exported to the Brazilian interconnected grid from sugarcane bagasse cogeneration at UTE Cocal I and UTE Cocal II. The ISCC CORSIA PLUS certification pertains exclusively to ethanol produced from sugarcane juice, not to electricity generated from bagasse. Therefore, there is no overlap between the sustainability claims associated with SAF feedstock under CORSIA and the emission reductions claimed under this CoU project. The two instruments address different product streams (ethanol vs. exported electricity), different carbon accounting boundaries (lifecycle emissions of aviation fuel vs. grid-displaced electricity), and different end-users (airlines vs. electricity consumers). This separation ensures the avoidance of double counting between CORSIA and CoU crediting.

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

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

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



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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 the 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.

Leakage Emissions (LE_y):

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

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

No change in carbon stocks: In the absence of the project, the bagasse would be left to decompose aerobically, releasing biogenic CO_2 and CH_4. The project's controlled combustion in high-efficiency boilers avoids CH_4 emissions from decomposition, resulting in a positive environmental effect — not a leakage source.

No equipment transfer: All boilers, turbines, and generators within the project boundary are dedicated exclusively to the project activity. No equipment was transferred from another activity that would continue operating with increased emissions elsewhere.

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

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

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

Hence $LE_y = 0$

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Project Emissions (PE_y):

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

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

Where,

- $PE_{(FF,y)}$ = Fossil Fuel Co-firing. CO_2 emissions from fossil fuels (diesel, coal, natural gas) co-fired with biomass in the boilers. If no fossil fuels are used, this is zero.

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

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

- $PE_{(Biomass,y)}$ = Biomass Combustion (CH_4/N_2O)

Emissions from biomass burning. CO_2 is excluded (biogenic), but CH_4 and N_2O may be included if the baseline considered uncontrolled burning. For bagasse combustion, these are negligible.

Scenario	Source	GHG	Included?	Justification/Explanation
Baseline	Grid Connected Electricity Generation	CO_2	Yes	Main emission source
		CH_4	No	Not identified in the baseline methodology
		N_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

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CH_4 and N_2O emissions from bagasse combustion in controlled, high-efficiency industrial boilers are negligible and not quantified for the following reasons:

Combustion conditions: The project boilers operate at high temperatures with controlled air-to-fuel ratios, achieving over 99% combustion efficiency. This minimizes the formation of CH_4, which results from incomplete combustion.

Emission factors: Per the 2019 IPCC Refinement to the 2006 Guidelines, CH_4 emission factors for biomass combustion in industrial boilers are approximately 0.03 kg CH_4/TJ — one to two orders of magnitude lower than emission factors for uncontrolled or open biomass burning (0.3–3 kg CH_4/TJ). At this level, CH_4 emissions are insignificant relative to the project's total emission reductions.

Fuel nitrogen content: Sugarcane bagasse has very low nitrogen content (0.1–0.4% by mass). N_2O formation during combustion is therefore minimal. The IPCC default emission factor for N_2O from biomass combustion in industrial boilers is approximately 0.004 kg N_2O/TJ, representing a negligible contribution in CO_2-equivalent terms.

ACM0006 consistency: ACM0006 (Version 16, Table 2) notes that CH_4 from biomass combustion may be considered but does not require quantification when baseline emissions do not account for these gases. The project baseline was calculated using the Brazilian grid combined margin emission factor (Tool 07), which is based on CO_2 emissions from fossil fuel-fired power plants and does not include CH_4 or N_2O components.

CH_4 and N_2O emissions from bagasse combustion are negligible and excluded per ACM0006 Table 2, consistent with conservative methodology application and CDM precedent for similar biomass projects, therefore:

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

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

The project is self-sufficient, therefore:

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

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

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

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

- $\mathbf{PE_{(BG2,y)}}$ = Biogas-Related Emissions. Emissions from biogas generation or leakage if a biogas system is present.

Since this project exclusively uses sugarcane bagasse as its primary biomass fuel, therefore:

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

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- **$PE_{(Transport,y)}$** = Off-site Biomass Transportation CO_2 emissions from transporting biomass to the project site from external sources.

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

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

For the Cocal Termoelétrica S/A project: all seven components are zero, explicitly declared with justification, not omitted.

$PE_y = 0$

The actual emission reduction achieved during the first issuing period shall be submitted as a part of monitoring and verification. For an ex-ante estimation for the period from 2013 to 2025, the following calculation has been submitted:

Emission Reductions are calculated as follows:

$ER_y = BE_y – PE_y – LE_y$

Where:

ER_y = Emission reductions in year y (tCO_2/y)
BE_y = Baseline Emissions in year y ($t\ CO_2/y$)
PE_y = Project emissions in year y (tCO_2/y)
LE_y = Leakage emissions in year y (tCO_2/y)

Estimated Annual Baseline Emission Reduction:

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

Where:

BE_y = 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 follows:

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

Where:

$\mathbf{EF_{grid,BM,y}}$	= Build margin CO_2 emission factor in year y (t CO_2/MWh)
$\mathbf{EF_{grid,OM,y}}$	= 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 operating margin and build margin emission factors, the publicly available data for 2024 published by the Ministry of Science, Technology and Innovation were used.

OM = 0.4473

BM = 0.0523

Resulting in: $EF_{grid,CM,y} = 0.2498$

Annual net exportable average considered conservative for the ex-ante period:

Estimated power generation per year is 300,000 MWh

Resulting in: $BE_y = 74{,}940\ tCO_2$

Since the project is a biomass co-generation project:

$PE_y = 0$
$LE_y = 0$

So as result $\mathbf{ER_y = BE_y}$

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.

$ER_y = 74{,}940 \times 0.9 = 67{,}446\ tCO_2$ / year

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Parameter	Value	Unit
Title	Estimated Emission Reductions (ER Ex-ante) - PCN COCAL ENERGIA	
Period	Jan 01, 2013 to Dec 31, 2025	
Reference	Section B.5 of PCN v1.0	
Calculation Date	September 11, 2026	
EFgrid,CM,y = EF grid,OM,y × wOM + EF grid,BM,y × wBM		
wOM	0,5	
wBM	0,5	
OM (2024)	0,4473	
BM (2024)	0,0523	
Grid Emission Factor (EFgrid,CM,y)	0,2498	tCO2/MWh
Estimated Annual Generation	300000	MWh/year
Baseline Emissions (BEy)	74940	tCO2/year
Project Emissions (PEy)	0	tCO2/year
Leakage Emissions (LEy)	0	tCO2/year
Gross ER	74940	tCO2/year
Conservative Adjustment (10%)	0,9	
Final Estimated ER	**67446**	**tCO2/year (CoUs/year)**

Estimated Annual emission reductions: ERy = 67,446 tCO_2 / year (67,446 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.

COCAL TERMOELÉTRICA S/A 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. 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.

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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:

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

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:

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$$CBIOs = \frac{Vbio \text{ x } LCV \text{ x } NEEA \text{ x } D}{10^3}$$

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:

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

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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: Jan 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: 13 years – Jan 01, 2013 to Dec 31, 2025

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B.10. Monitoring plan>>

All energy generation data is acquired through CCEE meters installed in COCAL TERMOELÉTRICA S/A substation.

Meter	Serial Number	Specification
1	MW-2403A650-02 (Main) UTE 1 – Paraguaçu Paulista (PPT)	Schneider Power Logic ION 8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2024 Last Calibration: December 10, 2024 Installation Code: SPCTCOUS---01 (L) P
2	MW-2302B065-02 (Check) UTE 1 – Paraguaçu Paulista (PPT)	Schneider Power Logic ION 8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1,8 Wh-varh/pulse Year of manufacturer: 2023 Installation Code: SPCTCOUS---01 (L) R
3	MW-2508A930-02 (Main) UTE 2 – Narandiba (NRD)	Schneider Power Logic ION 8650 3 Phases 57.7 ~ 220 V 1 A /5 A (max 20 A) 60 Hz Class D kh 1,0 Wh-varh/pulse Year of manufacturer: 2025 Last Calibration: March 10, 2026 Installation Code: SPCOA2TR1--01 (L) P
4	PT-0801A085-01 (Check) UTE 2 – Narandiba (NRD)	Schneider Power Logic ION 8600 3 Phases 57 ~ 277 V 2.5A 60 Hz Class D kh 1,8 Wh-varh/pulse Last Calibration: March 30, 2022 Installation Code: SPCOA2TR1--01 (L) R

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Meter 1: UTE 1 – Paraguaçu Paulista (PPT) - (Main)



Meter 2: UTE 1 – Paraguaçu Paulista (PPT) - (Check)



Meter 3: UTE 2 – Narandiba (NRD) (Main)



Meter 4: UTE 2 – Narandiba (NRD) (Check)

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The meters are locked and can be accessed or adjusted only under CCEE or ONS authorization. All generation data is available digitally and can be checked by the COCAL TERMOELÉTRICA S/A personnel through CCEE system at CCEE website.

Parameters being monitored or used in emission reductions determination:

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

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 and parameters monitored (ex-post):

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 ensure the reliability of the data, the national grid, and the 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.

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