SUGARCANE RENEWABLE ENERGY (SUCRE)

Terminal Evaluation Report

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Abbreviations

ABC	Brazilian Agency for Cooperation
ANEEL	Brazilian Electricity Regulatory Agency
CEO	Chief Executive Officer
CH_4	Methane
CNPEM	Brazilian Center for Research in Energy and Materials
CO_2	Carbon dioxide
CTBE	Brazilian Bioethanol Science and Technology Laboratory
CTC	Sugarcane Technology Center
EPE	Energy Research Office
GEF	Global Environmental Facility
GHG	Greenhouse gases
Gt	Gigatons (10^9 tons)
GWh	Gigawatt hour
N_2O	Nitrous oxide
LBNR	Brazilian Biorenewables National Laboratory
MCTI	Ministry of Science, Technology and Innovation
MME	Ministry of Mines and Energy
MRE-ABC	Ministry of Foreign Affairs-Brazilian Cooperation Agency
M&E	Monitoring and evaluation
Mt	Megaton (10^6 tons)
MW	Megawatt
MWh	Megawatt hour
NDC	Nationally Determined Contribution
PIF	Project Identification Form
PIR	Project Implementation Report
t	Ton (10^6 grams)
TPES	Total Primary Energy Supply
TWh	Terawatt (10^{12}) hour
UNDP	United Nations Development Programme
UNICA	Brazilian Sugarcane Industry Association

Executive Summary

Project Information Table

Project details		Project milestones	
Project title	Sugarcane Renewable Energy (SUCRE)		
UNDP Project ID (PIMS #):	3515	PIF Approval Date:	01/06/2008
GEF Project ID:	2778	CEO Endorsement Date:	03/03/2010
UNDP Atlas Business Unit, Award ID, Project ID:	BRA/10/G31	ProDoc Signature Date:	22/12/2010
Country:	Brazil	Date Project Manager hired:	June 2015 June 2017
Region:	Latin America	Inception Workshop date:	25/08/2015
Focal Area:	Climate Change	Mid-Term Review Completion Date:	June 2019
GEF Operational Programme:	GEF-4 | CC- SP3 | CC-SP4	Terminal Evaluation Completion Date:	30/10/2020
Implementing Partner (GEF Executing Entity)	CNPEM	Planned Operational Closure Date:	31/12/2019
NGOs/ CBOs involvement	Not applicable	Actual Operational Closure Date:	30/06/2020
Private sector involvement	12 partner sugar mills		
Financial information			
PDF/PPG	at approval (US$M)	at PDF/PPG completion (US$M)	
GEF PDF/PPG grants for project preparation	7,800,000.00	7,800,000.00	
Co-financing for project preparation			
Project	at CEO Endorsement (US$)	at TE (US$M)	
[1] UNDP contribution:			
[2] Government:	3,750,000		
[3] Other multi-/bilaterals:			
[4] Private Sector:	55,800,000	120,000,000	
[5] NGOs:	100,000		
[6] Total co-financing [1 + 2 + 3 + 4 + 5]:			
[7] Total GEF funding:			
[8] Total Project Funding [6 + 7]	59.650,000	127,000,000	

Brief description of the project

Brazil's electricity generation is dominated by hydropower, which represented 80% of total generation in 2010. However, hydropower is vulnerable to drought, as manifest in the 2001 energy crisis. For this reason, Brazil has been trying to diminish its dependency on dams for power generation. Yet, to ensure GHG emissions mitigation, it needs to enhance the share of renewable energy sources. Solar and especially wind power has expanded dramatically since 2010, but those sources still need a reliable back-up technology, as they are not always available. In Brazil, gas-fired power plants play this role and represent the second power source in Brazil. Biomass plants are a reliable, low-carbon alternative to gas. Brazilian sugar mills have decades-long experience in power generation with sugarcane bagasse produced in the milling process. Bagasse can be stored and used as fuel beyond harvesting season, thus representing a reliable power source. As mechanized harvest is becoming more common in sugarcane fields in Brazil's most important sugar-producing region, centered around the state of São Paulo, a new source of biomass has become available: sugarcane outer leaves and tops (sugarcane trash).

The phasing out of pre-harvest burning in São Paulo was enacted into law in 2002, foreseeing a transition period of over 25 years. However, its phase-out and consequent adoption of mechanized harvesting were happening faster than expected, reducing CO_2 emissions from burning but leaving significant amounts of sugarcane trash on the fields. While sugarcane trash on the soil can have positive agronomic effects (mulching, prevention of erosion), it complicates pre-harvest activities and favors the spread of agricultural pests. The expansion of mechanical harvest and the increasing amount of trash made this problem manifest. The amount of trash left on fields being of the same magnitude as the bagasse produced in the milling process and having similar calorific value, sugarcane trash was a promising fuel for power generation.

However, trash collection and burning in bagasse boilers present significant technical problems that had not been solved at a commercial scale when the GEF's funded project Biomass Power Generation (BPG) project ended in 2006. Indeed, the export of electricity by sugar mills was lower than expected at the project's development stage. However, the BPG project demonstrated that using sugarcane trash as fuel in mill co-generation was technically feasible and likely to be economically viable. Based on that encouraging results, the implementing partners of Biomass Power Generation, the sugarcane industry-affiliated Sugarcane Technology Center (CTC), and the GEF agency United Nations Development Program in Brazil (UNDP) developed a project to catalyze the commercial use of sugarcane trash as a fuel for co-generation: Sugarcane Renewable Energy (SUCRE). SUCRE set out to surmount the following main barriers to the expansion of electricity exports from sugar mills identified in its project document:

Infrautilization of trash as fuel due to technical challenges in collection and processing
Grid auction rules do not take the characteristics of power generation at power(sugar) mills into consideration

SUCRE intended to develop the necessary technical solutions and evaluate their performance to demonstrate commercially viable power generation with sugarcane trash in at least three mills in Brazil’s main sugarcane producing region: the Central-South region centered around the state of São Paulo. SUCRE was designed to also bring about positive environmental and

social impacts, including avoidance of GHG emissions and generation of formal, quality employment

The project could not start implementation in 2010 as planned, as the implementing partner, the CTC, became a corporation and thus ineligible as an implementing partner for a GEF project. Yet, the UNDP country office in Brazil succeeded in maintaining institutional interest in the project, especially by the Ministry of Science and Technology and Innovations (MCTI). The UNDP conducted a substantive review of the project document in 2013 that identified a suitable implementing partner: the Brazilian Bioethanol Science and Technology Laboratory (CTBE), now National Laboratory for Biorenewables Research (LNBR). The LNBR is one of the four laboratories of the Brazilian Center for Research in Energy and Materials (CNPEM), a non-profit private institution funded by the MCTI). SUCRE could finally start implementation in 2014.

Evaluation Ratings Table

1. Monitoring & Evaluation (M&E)	Rating
M&E design at entry	Satisfactory
M&E implementation	Satisfactory
Overall Quality of M&E	Satisfactory
2. Implementing Agency (IA) Implementation & Executing Agency (EA) Execution	Rating
Quality of UNDP Implementation/Oversight	Highly Satisfactory
Quality of Implementing Partner Execution	Highly satisfactory
Overall quality of Implementation/Execution	Highly Satisfactory
3. Assessment of Outcomes	Rating
Relevance	Highly satisfactory
Effectiveness	Highly satisfactory
Efficiency	Highly Satisfactory
Overall Project Outcome Rating	Highly satisfactory
4. Sustainability	Rating
Financial Sustainability	Likely
Socio-Political Sustainability	Likely
Institutional Framework and Governance Sustainability	Likely
Environmental Sustainability	Likely
Overall Likelihood of Sustainability	Likely

Concise summary of findings and conclusions

The project has exceeded expectations, achieving or exceeding all its targets. The project has been extraordinarily successful in engaging 12 important sugar mills (2 more than initially expected), including some of Brazil's most prominent sugar industry players. Despite being competitors, sugar mills proactively cooperated with the project, facilitated field experiments, and tried and shared results from project-supported trash collection and processing systems. Thus, SUCRE and its partner mills have significantly contributed to Brazil's emissions and

renewable energy Nationally Determined Contribution (NDC) targets. Catalyzed by SUCRE, the four first batch partner sugar mills are currently (2019) exporting 1.14 TWh/year to the grid using bagasse and trash as fuel, avoiding the emission of 0.58 MtCO2e (2.38 MtCO2e during the five-year implementation period compared with the emissions from a gas-powered plant). SUCRE also evaluated the feasibility of optimizing trash use at eight additional mills, potentially increasing sugarcane-powered electricity exports by 30% from the current 2.77 TWh/year exported by the twelve project partner mills. Sugarcane biomass has increased from 4% to 7% of Brazil's total electricity from 2010 to 2020. With the support of the new biofuels policy RenovaBio and the need to increase the share of no-hydro renewables in the Brazilian energy mix, grid exports from sugarcane mills are expected to grow by adding installed capacity (new capacity and existing mills not yet exporting) and from using sugarcane trash as fuel. With the current installed capacity, SUCRE projects that optimal utilization of sugarcane biomass (trash and bagasse) could generate up to 142 TWh/year. As mechanical harvest expands over the most important sugar-producing states, more trash becomes available as fuel, adding to sugarcane's power generation potential. As of 2019, 97% of Brazil's Center-South region's sugarcane is harvested mechanically.

SUCRE has proposed policy reforms to incentivize sugarcane electricity exports that have been disseminated among regulatory and policymaking institutions. However, these reforms could not be passed during the project implementation period. Yet, even in the absence of reforms, electricity prices are attractive enough for the mills that the project's partner mills have invested an estimated US$120 million in equipment to optimize co-generation and use of sugarcane trash during SUCRE's implementation period. Hence, the project has achieved a genuine catalyzing effect, helping mainstream using a so far neglected resource by developing technical solutions that can now be left to market forces.

SUCRE has produced evidence on sugarcane's environmental and social impacts to address concerns about sugarcane's potential environmental impacts as a driver of deforestation and pollution. On the first topic, SUCRE demonstrated that the sugarcane industry is not a net contributor to deforestation or water quality degradation. On the second, it has shown the sugarcane energy sector's potential to generate higher-paying formal jobs than other power sources.

The project's success has a high potential for replication in other sugar-producing countries. In this regard, SUCRE's team has reached out to counterparts in countries like Guatemala, Colombia, and Argentina, where the sugarcane industry has shown keen interest in the Brazilian experience. Expansion of sugarcane biomass power generation to other suitable areas in Sub-Saharan Africa and Asia could become a source of low-carbon, affordable and clean energy and catalyze capacity development and formal employment.

Synthesis of the key lessons learned

- There are significant opportunities to replicate SUCRE’s emission mitigation success in other sugarcane growing areas, in the frame of GEF or bilateral funded projects, as well as South-South cooperation.

- Replication of SUCRE's success needs identifying an implementation or responsible partner with sufficient technical and administrative capacity, and the necessary integrity due in dealing with intellectual property rights and confidential business information. Government environmental agencies and ministries or civil society organizations, which are usual implementing partners of GEF supported projects could not be suitable to effectively implement similar projects involving private and government actors.

- A second necessary condition to replicate SUCRE's success is the presence of a robust institutional framework and a degree of enforcement of environmental regulations. Without enforcement of mechanized harvest, public support for clean energy (e.g. RenovaBio), SUCRE would not have achieved its targets.

- Support for renewable energy generation must account for social and environmental externalities with reliable, independent, and credible research. The independent studies on impacts of sugarcane cultivation and trash use on deforestation, water resources and employment ensured the virtual absence of negative externalities from this mitigation effort.

- Policy reforms follow complex political procedures that make them unsuitable as commitments to be fulfilled within a project's implementation period.

Recommendations Summary Table

Rec #	TE Recommendation	Entity Responsible	Time frame
A	Category 1: Consolidation of results		
A.1	should continue to promote and disseminate the scientific papers and knowledge products generated by the project	UNDP and CNPEM-LNBR	2020-2021
A.2	Design a project support enhancement of biomass generated power, e.g. support to development of second-generation biofuels, substitution of fossil fuels in harvest and transport operation of sugar mills and management of vinasse fertigation	UNDP and CNPEM	2020-2022
B	Category 2: Replication of results		
B.1	Design a project to support development of solutions for mechanical harvest and biomass co-generation in the Northeast of Brazil.	UNDP CO	2020-2023
B.2	Identify suitable implementation agencies, in the model of CNPEM-LNBR (responsible-partner type execution) to replicate SUCRE. Priority countries could be Cuba and Argentina in Latin America and Thailand and the Philippines in Asia	UNDP regional offices LAC and AP	2020-2023

1 Introduction

Purpose of the evaluation, purpose of this report.

As mandatory for all GEF-funded, UNDP-implemented projects, SUCRE undertakes an independent terminal evaluation. The evaluation was commissioned in June 2020 to assess and disclose the extent of project accomplishments and to synthesize lessons that can improve future UNDP-GEF projects' development and implementation.

The inception report aims to outline the evaluation questions and the research methods proposed to obtain their answers based on the UNDP-GEF guidelines for terminal evaluations.

Evaluation questions and criteria

The UNDP-GEF guidelines for project terminal evaluations follow the OECD Development Assistance Committee's evaluation criteria of relevance, effectiveness, efficiency, sustainability, and impact. These five criteria are the frame for the evaluation questions (annex 1, evaluation matrix) answered by this evaluation report.

Methodology

The evaluation used qualitative semi-structured interviews with stakeholders and a literature review and document analysis of project reports and knowledge products.

The literature review includes peer-reviewed papers, including those prepared by the project team, the project documents and evaluation reports of projects related to energy generation from biomass, such as the GEF-1 project Biomass Power Generation: Sugar Cane Bagasse and Trash. The review supported the evaluation of the context of the project and the soundness of the project strategy.

The evaluation of the project's relevance was based on the project's alignment with government policy at the federal level, primarily Brazil's Nationally Determined Contribution (NDC).

Evaluation of the project effectiveness, achievement of targets, and sustainability needed the information contained in project reports, such as Progress Implementation Reviews (PIRs), annual progress reports (APRs), semi-annual progress reports, and the Midterm Review report, as well as the project's knowledge products (technical reports, guidelines, papers) and technical reports.

In contrast, combined delivery reports (CDR), co-finance reports, UNDP audit reports, mission reports, and minutes of steering/ technical committee meetings offered insights about the project finances and co-funding, adaptive management, and agency performance.

Due to the on-going Covid-19 pandemic, field visits and interaction with project stakeholders have been entirely restricted. Thus, project stakeholders were interviewed through online means, and no field visits were conducted.

Interviews were held with representatives of the GEF agency (UNDP), implementing partner (LNBR), and representatives from participating sugar mills, as well as the Brazilian Sugarcane Industry Association (UNICA). Interviews were held with officials of the federal ministries of Science, Technology, and Innovation(MCTI) and Foreign Affairs and Cooperation (MRE-ABC). Annex 2 list the topics to be addressed in the semi-structured interviews with the different respondents.

The evaluator will adhere to the OECD's ethical criteria for evaluation and its code of conduct. The signed code of conduct is attached to this report.

Limitations.

Due to the on-going COVID-19 pandemic no field visits were possible. All interviews with project stakeholders were conducted remotely by the international consultant. Independent information on the actual situation at the mills was extracted from the MTR, which was concluded in 2019.

2. Project Description

Project development objectives and milestones

The project Sugarcane renewable electricity (SUCRE) aimed to avoid GHG emissions by catalyzing the establishment of a commercial market for sugarcane-based electricity supply to the Brazilian grid and promoting the use of sugarcane trash (the tops and the leaves of the sugarcane plant) at a commercial scale for electric power generation in sugarcane mills. Specifically, the project's implementation would lead to the avoidance of 240.000 t of CO2 emissions per year (using natural gas generation as baseline).

SUCRE builds on the GEF-1 Biomass Power Generation project that demonstrated that sugarcane trash enables year-round surplus power generation at sugar mills[1].

SUCRE's concept (PIF) was submitted and approved by GEF in 2007, and the project received the CEO endorsement in 2010. SUCRE should have started implementation on that same year, under the 4th GEF cycle, but due to the status change of the implementing partner (explained below), the project was delayed till 2015. The project underwent a midterm review in June 2019 and was operationally closed by June 2020.

Development context.

Economic growth and politics

After the recession and political crisis that the country has experienced since 2014, economic growth recovered somehow by 2017, albeit at relatively modest rates. As economic growth is the primary driver of GHG emissions[2], the slow growth rate and the effects of the COVID-19 pandemic should keep energy and agricultural emissions at around current values (nearly 2 $GtCO_2e$) for the next years and they could, in fact, fall by 4-3% over the next two years, excluding emissions related to land use, land use change and forestry[3].

[1] Biomass Power Generation was implemented between 1998 and 2006 by the UNDP with the Centro de Tecnologia Canaveira (CTC) as responsible partner under the Ministry of Science and Technology **Invalid source specified.** (Larson, 2003) (GEF, 2020)

[2] (Blanco, et al., 2014)

[3] Total and LULUCF-related emissions have been stable since 2009, oscillating around 1.96 ± 0.14 $MtCO_2e$ and 0.88 ± 0.13 $MtCO_2e$, respectively but agricultural and energy sector emissions had been growing, since the mid-2000s at rates of 1.1 and 5% respectively, until 2014. From 2014 to 2018 they have declined by 0.2 and 4% annually respectively (CAIT Climate Data Explorer, 2019) (Observatório do Clima, 2018) (Gütschow, et al., 2016). GDP (GDP at current US$, (World Bank, 2020) and non-LULUFC emissions for Brazil are strongly correlated (df=29, R^2=0.77, p=$1.4*10^{-10}$) with a elasticity of 0.4. An economic contraction of 6-9% is forecast for 2020 (Andreoni, 2020), (OECD, 2020) and 7% for 2021 (OECD, 2020). Thus, with an elasticity parameter of 0.4, emissions should be reduced by 3-4%. LULUCF emissions may rise linked to the recent rise in fires in the Amazon and Pantanal biomes.

Sources and trends of GHG emissions in Brazil

Yet at around 2 $GtCO_2e$ a year, Brazil is still among the top ten global total GHG emitters[4]. Energy and agriculture represent between half and two-thirds of its total emissions, while deforestation and land degradation drive most of the other half (or one third).[5]

Land-degradation and forestry related emissions used represented three-quarters of Brazil's total GHG emissions. However, emissions dropped by 60-71% since 2004, due to a combination of increased enforcement and trade agreements[6]. Despite this dramatic reduction, emissions grew driven by the energy and agricultural sector[7].

Agricultural emissions (25-38% of total emissions) are mostly a product of CH_4 emissions from livestock (64%) and soil emissions (CO_2, N_2O, and CH_4, 28%). Meanwhile, the burning of crop residues represents merely 1% of agriculture and livestock-related emissions[8]. The low contribution of burning crop residues to total agricultural emissions is related to the phasing out of burning in the Central-West region, Brazil's most productive agricultural region. The phasing out of pre-harvest burning in São Paulo was enacted into law in 2002, foreseeing a transition period of over 25 years. However, the quick adoption of mechanized harvesting, at least in flatland (slopes under 12%), has resulted faster than expected, even at the project design stage. Currently (2019), 97% of São Paulo's sugarcane is harvested mechanically, increasing the amount of sugarcane trash available above expectations at project design.

The energy sector (36-21% of total emissions) comprises transportation, electricity generation, and manufacturing. Transportation and manufacturing represent 63% of the energy emissions, while electricity and heating only 21%. The latter are the product of power generation from fossil fuel sources, oil, gas, and coal, representing 15% of the national power supply. Brazil's mitigation targets include substituting the share of fossil fuels in its energy mix by increasing the percentage of biofuels and renewable power sources, precisely the overall development objective of this project.

Bioenergy in Brazil and mitigation potential

Brazil was at the time of project design and still is the world leader of sugarcane production. Half of the sugarcane production in Brazil is turned into ethanol. Brazil is currently the second-largest producer of bioethanol, generating a third of the world's supply[9]. From 1975 to 1999, the federal program Proálcool successfully turned ethanol into the sugar mills' top energy product. Production of Brazilian sugarcane-based ethanol is projected to increase by 80% till 2030, mostly driven by internal demand with support from the federal government program RenovaBio. RenovaBio aims to boost bioethanol share in the energy mix and increase annual

[4] (Azevedo, et al., 2018)
[5] Figures vary according on sources. While WRI's CAIT (CAIT Climate Data Explorer, 2019) estimates total emissions at 1.3 Gt CO_2e (2016, last year of CAIT, but previous years similar values and shares) and approximately equal contributions from the agriculture and energy sectors that add up to 0.75-0.66 of the total emissions, the non-profit coalition Observatório do Clima (Azevedo, et al., 2018) estimates total emissions at around 2 Gt CO_2e (1.9 in 2018, last year of the series, but similar in previous years) and higher shares of LULUFC.
[6] (Nepstad, et al., 2014)
[7] (Observatório do Clima, 2018) (CAIT Climate Data Explorer, 2019)
[8] (Observatório do Clima, 2018)
[9] (Bordonal, et al., 2018)

production to 50 billion liters per year by 2030 [10] (last year's production reached 33.1 billion liters[11]).

Bioethanol strongly contributes to further Brazil's mitigation goals: *in contrast to corn ethanol, the Brazilian sugarcane ethanol system may offset 86% of CO2 emissions than oil use, and emissions resulting from land-use change are mitigated in just 2–8 years*[12].

Brazilian sugar mills are energetically self-sufficient thanks to co-generation using bagasse as fuel and export some electricity to the grid. Export to the grid by sugar mills was incentivized by policy reforms in 2004, enabling independent power producers, such as sugar mills, to sell at competitive prices. Electricity generation from biomass (fundamentally from sugar mill co-generation) rose from 4% in 2007 to 9% of Brazil's total electricity by 2017[13].

Sugarcane and environmental impacts

Sugar mills and sugarcane fields are concentrated in Brazil's Southeast and Centre-West regions, mostly in São Paulo, Goiás, and Minas Gerais (54, 11, and 10% of the national output in 2019, respectively)[14].

The area dedicated to sugarcane has expanded by 131% over the last 25 years[15]. Sugarcane fields covered estimated 100,422km^2 in 2018[16] (3.5% of total arable land in Brazil)[17] The direct impact of this expansion on natural forest or Cerrado vegetation is negligible, as sugarcane has expanded over former pastureland and annual crops[18]. Estimations based on satellite imagery by this project show that over 200,000 km^2 of pastureland in the Central-South region are suitable for producing sugarcane.

Improvements in yield also mean that the sugarcane harvested area has increased very moderately compared to other commodities, particularly soybeans or cattle ranches, which are the main drivers of deforestation in Brazil[19].

Problems that the project sought to address.

How the project objectives fit into the partner government's strategy

Brazil's 2015 NDC unconditionally pledged to mitigate its GHG emissions to 37% of its 2005 levels by 2025, to be achieved through forest and pastureland restoration, and increasing the energy mix's renewable share. The 2030 NDC energy target is for renewable energy achieving 45% of its total energy mix. "*This includes expanding the use of renewable energy sources other than hydropower in the total energy mix to between 28% and 33% by 2030, and expanding the*

[10] (Bordonal, et al., 2018)
[11] (Companhia Nacional de Abastecimento (CONAB), 2018)
[12] (Jaiswal, et al., 2017), (Bordonal, et al., 2018)
[13] (International Energy Agency (IEA), 2020)
[14] (Companhia Nacional de Abastecimento (CONAB), 2018)
[15] (FAO, 2020)
[16] (FAO, 2020)
[17] (FAO, 2020)
[18] Although there may be some indirect impacts if pasturelands are displaced into the fragile Amazonian ecosystems (Bordonal, et al., 2018)
[19] (Soterroni, et al., 2018)

use of non-fossil-fuel energy sources domestically, by increasing the share of renewables (other than hydropower) in the power supply to at least 23% by 2030, including by raising the share of wind, biomass and solar"[20].

By 2018, Brazil's GHG emissions represented 35% of its 2005 levels, ahead of the NDC's milestones. This reduction is mostly due to a decrease in LULUCF emissions of at least 60% since 2005. However, energy emissions have grown by at least 30%[21]. Despite the growth in emissions, the renewable's target for 2030 (45% of TPES) was reached by 2018. Non-hydro renewable sources (wind, biomass, solar) represented 18% of the total Brazilian power supply in 2018[22].

Biomass and especially wind[23] have been growing fast since 2005, although their growth rate has slowed down since 2014. Wind energy keeps an annual growth rate of nearly 25% and has surpassed biomass power in 2019. Yet biomass' power supply is still growing at a rate of almost 4% annually[24].

How the project would solve barriers to increasing the non-hydro share of power generation

Hence, Brazil is well on track to achieve its ambitious mitigation commitments. However, during the initial project design phase in 2009 and its substantive revision in 2013-15, GHG emissions from the energy sector grew at a 5% annual rate. Non-hydro renewable sources amounted to merely 7-12% of electrical power generation in Brazil, and biomass just 5-8%. Indeed, during the project's design phase, the export of electricity by sugar mills was lower than expected, as only 10% of the sugar mills exported their co-generated electricity to the grid. By 2013 just 130 mills (35%) were exporting co-generated electricity to the grid (54% in 2017). Meanwhile, green harvest left 80% of green trash in the fields, a quantity of the same magnitude as the bagasse produced in the milling process.

As demonstrated by the Biomass Power Generation project, trash has energy characteristics similar to the bagasse, make it a promising fuel for power generation. While sugarcane trash can have positive agronomic effects (mulching, prevention of erosion), it complicates pre-harvest activities and favors the spread of agricultural pests. The expansion of mechanical harvest and the increasing amount of trash in the fields made this problem manifest. By 2013, mills were actively seeking solutions to remove the trash on their plantations.

Thus, the utilization of trash for power generation would bring about agronomic benefits and the potential for increasing co-generation and export to the grid of low-carbon electricity.

Yet, biomass electricity exports from power mills were not reaching its full potential due to a combination of technical and policy challenges (barriers). Trash collection and burning in

[20] (Government of Brazil, 2015)
[21] (Observatório do Clima, 2018) (CAIT Climate Data Explorer, 2019)
[22] 8.9% for biomass and 8% for wind in 2018 (International Energy Agency (IEA), 2020)
[23] Wind energy has grown exponentially since 2012 and may have surpassed biomass reaching 9.3% of power supply against 8.9% from biomass (Governo do Brasil, 2020)
[24] Based on an exponential regression model, with data from (International Energy Agency (IEA), 2020)

bagasse boilers present significant technical problems that had not been solved at a commercial scale when the Biomass Power Generation project ended in 2006. These technical challenges are linked to the impurities collected with the thrash, the different characteristics of trash and bagasse (humidity and granulometry), and transport cost from field to mill.

Beyond the technical barriers, the project needed to address one further policy barrier that hampers electricity export to the grid: auction rules discouraged mills from making investments in boiler technology, which would enable more significant power exports to the grid.

Description of the project's Theory of Change.

The project's strategy entails developing technical solutions for trash collection, assessing their environmental, agronomic, and economic feasibility, and promoting them in at least seven mills. The project's theory of change is graphically represented in figure 1 and described in the sections Findings/ Relevance of this report.

Total resources *identified for the project*

The GEF funded SUCRE through a grant amounting to 7,800,000 US$ from Brazil's climate change RAF-4 allocation (21% of the total climate change allocation). Together with the committed co-financing, mostly investments from the mill participating in the project, the total project cost amounts to US$ 67,450,900. Co-financing was redefined in the 2015 project revision as follows: the implementing agency, CTBE: 3,750,000 (6.3%), the Brazilian Sugarcane Industry Association (UNICA) US$ 100,000 (0.2%) and the participating sugar mills: US$ 55,800,000 (93.5%).

Summary of main stakeholders involved in the implementation

SUCRE was expected to be implemented between 2011 and 2015, under the National Implementation Modality (NIM) of the UNDP, with the Centro de Tecnologia Canavieira (Sugarcane Technology Center, CTC) as implementing partner. The CTC was founded in 1969 as the research unit of the sugar giant Copersucar. In 2004, CTC adopted its current name as it opened up to cooperation with companies and cooperatives not necessarily linked to Copersucar. CTC became a public limited liability company in 2011, with the most important sugar and ethanol operators as shareholders, accounting for 60% of the total Brazilian production capacity. However, this transformation made CTC ineligible as an implementing partner for a GEF-funded project.

In 2013, the UNDP conducted an assessment and revision that concluded that the project parameters were still valid and recommended the non-profit research institute Bioethanol Science and Technology Laboratory (CTBE), currently Brazilian Biorenewables National Laboratory (LNBR), as the implementing partner. The LNBR is a private, non-profit research and development institution under the supervision of the Brazilian Ministry of Science, Technology, and Innovations (MCTI). It is one of the four laboratories that make up the Brazilian Centre for Research in Energy and Materials (CNPEM). The CTBE was inaugurated in 2010 to deepen the scientific and technological knowledge associated with ethanol production. In 2018, the CTBE was renamed Brazilian Biorenewables National Laboratory, as it expanded its research scope

to include advanced biofuels and other bio-based products, processes, and materials. After selecting the new implementing partner, the UNDP concluded the substantive revision process, moving the project's closing date to December 2019. The first activities started between 2014 and 2015. Project implementation began in June 2015, after the first batch of mills (four) agreed to participate.

In June 2015, four mills in São Paulo agreed to engage with the project (first batch): Usina Quatá (Quatá), Usina da Barra (Barra Bonita), Usina da Pedra (Serrana), and Usina Alta Mogiana (São Joaquim da Barra). Usina da Pedra and Alta Mogiana experimented with trash collection and its use as fuel on their initiative before the project activation.

The project team evaluated a partial collection system (trash is collected together with the cane stalks), baling, and hay harvesters at the partner mills. The project also tested technologies for the separation of trash from cane stalks and its processing. Testing included technical and financial feasibility. Mills of the first batch have already begun using sugarcane trash as a fuel for electricity co-generation and reported exports to the grid to exceed project targets and expectations.

In 2017, eight more mills joined the project. Mills from the second batch were mostly located in São Paulo, but it included mills from the Central-western (Goiás), and Northeast (Alagoas), increasing the ecological and climatic range of the project. Batch 2 was composed of the following mills:

- Usina São Luiz de Ourinhos (Ourinhos, SP).
- Usina Ferrari (Porto Ferreira, SP).
- Usina Boa Vista (Quirinópolis, GO).
- Usina São José da Estiva (Novo Horizonte, SP).
- Usina Santa Isabel (Mendonça, SP).
- Usina Caeté (São Miguel dos Campos, AL).
- Cerradinho Bioenergia (Chapadao do Céu, GO).
- Usina Santa Terezinha (Paranacity, PR).

3. Findings

3.1 Project Design/ Formulation

Analysis of results framework: project logic and strategy, indicators

The project design clearly defined the problem to be addressed: sub-optimal grid exports from co-generation at mills prevent further GHG mitigation. Its root causes are technical challenges associated with collecting and processing sugarcane trash and unfavorable auction rules.

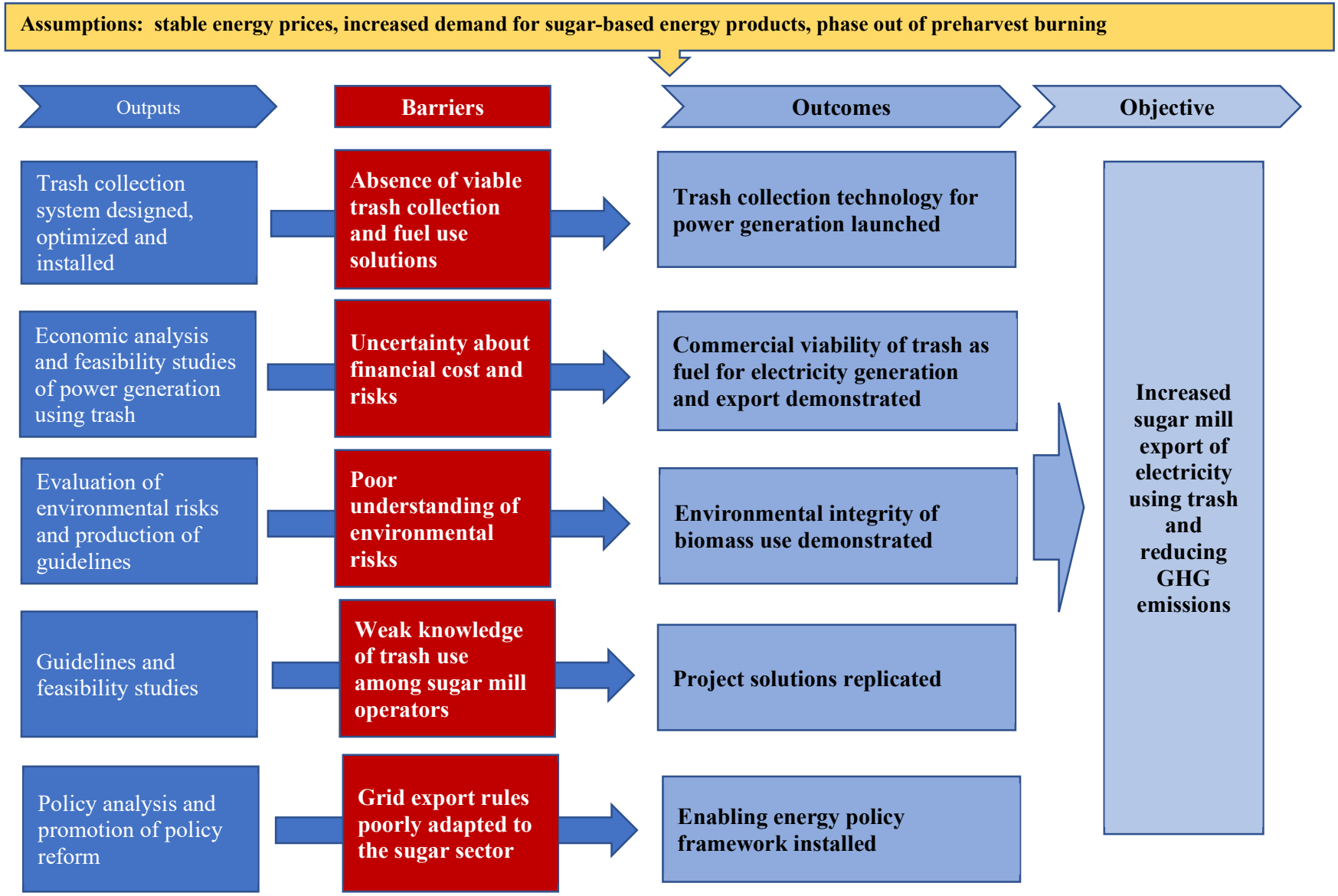
The five project results are designed to surmount the barriers identified (figure 1). Outcomes 1 to 4 seek to develop, demonstrate, and up-scale the environmental and economic feasibility of sugarcane trash collection, processing, and use as fuel for co-generation. Outcome 5 aimed at producing policy recommendations to promote biomass power export to the grid. The five effects are the logical result of the delivery of 24 deliverables or outputs. Key outputs include feasibly studies for sugarcane trash collection for co-generation, installation at the four participating mills and monitoring of performance for outcome 1 and 2, guidelines on trash collection based on monitoring of environmental effects for outcome 3, investment by the second batch of sugar mills for outcome four and adoption of regulatory changes suggested by the project for outcome 5.

The outputs were relevant and feasible during the project implementation timeframe. However, the project design may have underestimated the transaction costs involved in promoting policy reforms regarding power auctions. The project design foresaw very close cooperation with MCTI and the MME, EPE, and ANEEL. This close cooperation was challenged by the political turmoil that played out during the project's critical implementation years 2016-2018, and of course, by the unexpected occurrence of the COVID-19 pandemic in 2020.

The six indicators of the development objective included: increase of exports to the grid of electricity co-generated at sugar mills using trash from by 70% (60,000 MWh/ year to 180,000 MWh/ year), increase revenues from electricity export at participating sugar mills, investment in project solutions by at least one additional mill, and adoption of an enabling policy framework to encourage electricity generated using trash to the grid were SMART and directly linked to the project's development objective.

The project included 13 additional SMART indicators for outcomes. Section Finding/ Effectiveness reports progress towards the targets for all the six objective and thirteen outcome indicators. While the project's primary goal is the avoidance of CO_2 emission, this is only included as one indicator of outcome three: mitigation of between 1.2 and 3.75 million tons CO_2e a year.

Figure 1. Project's theory of change. Project results (outputs, outcomes) have been rephrased and summarized.



Assumptions and risks

The project assumes continued growth of electricity demand and the prevalence of mechanical harvest. The assumptions are well formulated and are necessary conditions for the project strategy to succeed.

The project assumed a continuing growth of electricity demand of 60% for 2015 with respect to 2005, based on the Energy Research Office projections. Despite the 2014 recession, power consumption and biomass power have risen in Brazil by 16% and 9%, respectively, between 2010 and 2018.

The phase-out of preharvest burning is well established in the South-Central region. The significant and positive health effects through improvements in air quality and the considerable investments made by mills to adopt mechanical harvest make a comeback of preharvest burning virtually impossible. However, this does not apply to the Northeastern region, where steeper fields make mechanical harvest unfeasible.

The project document identifies six technical, economic and environmental risks that are discussed in section Project Implementation/ Risk Management of this report.

Planned stakeholder participation

The project's main actors were the implementing agency, the CTBE-LNBR of the Brazilian Center for Research in Energy and Materials, and the participating sugar mills (3 for the initial batch plus 7 for the second batch). The ten mills of the project design became 12 during actual project implementation, as described in the section Project Description above. The project team (Technical Coordination Team) in the project document was composed of the National Project Director, an Assistant Project Director, and five project managers for technical, financial, environmental, and dissemination issues. Actual team composition and interaction with the participating mill will be described in section Project Implementation and Effectiveness.

The project board would integrate the GEF agency UNPD, the Ministry of Science, Technology, and Innovation (MCTI), and the Brazilian Agency for Cooperation (ABC). A project advisory committee, with the participation of the UNPD, MCTI, and the sugarcane industry through their association UNICA, would provide technical and political advice for the implementation of the project.

3.2 Project Implementation

Adaptive management

The project's midterm review (MTR) was conducted in 2018 after its third year of implementation (project started in June 2015. The MTR found the project implementation and progress towards results as satisfactory and on track and formulated recommendations that helped the project consolidate its final outputs. Namely, the MTR recommended extending the project for an additional semester to enable the project to enhance the dissemination of project results, particularly the critical discussion of the project's recommendations to incentivize grid exports by biomass-based independent power producers such as the project partner mills.

The project team prepared a management response duly discussed and approve with the project board. The actions in response to the MTR recommendations are still being executed.

Actual stakeholder participation and partnerships agreements

SUCRE succeeded in engaging more partner mills than initially foreseen in the project document. Sugar mills were initially reluctant to engage with the project, as sharing information could lose competitive advantage to other participating mills. The project team showed remarkable professionalism and aptitude to engage and cooperate with several industry actors of different financial and crushing capacities. The reputation of the CNPEM-LNBR certainly helped to ease any concerns that the participating mills may have had.

SUCRE is remarkable in successfully engaging with highly competitive private sector actors, not only avoiding any conflict but succeeding in raising their interest to the point of mobilizing co-funding for the outcomes of this project, amounting to an estimated US$ 134 million (See section Finance and Co-Finance).

The project design did not foresee the engagement of government agencies related to the regulation of the energy market, such as the Ministry of Mines and Energy (MME), the National Electricity Agency (ANEEL), and the Energy Research Office (EPE). The project strategy demonstrated the technical and economic feasibility of using trash for the cogeneration of electricity and analyzing the energy market before reaching out to the market regulators with any policy reforms proposals.

Once the corresponding analysis was concluded, and the policy recommendations were formulated, SUCRE reached out to the Ministry of Mines and Energy. Here, a more intense engagement of the MCTI supporting the CNPEM-LNBR to disseminate and promote the project-developed recommendations could have helped leverage them and facilitate their adoption. The general climate of political instability during a good part of the project's implementation period, including several changes of government and polarization of politics and society, may explain the timid engagement of the MCTI.

Project finance and co-finance

Financial management

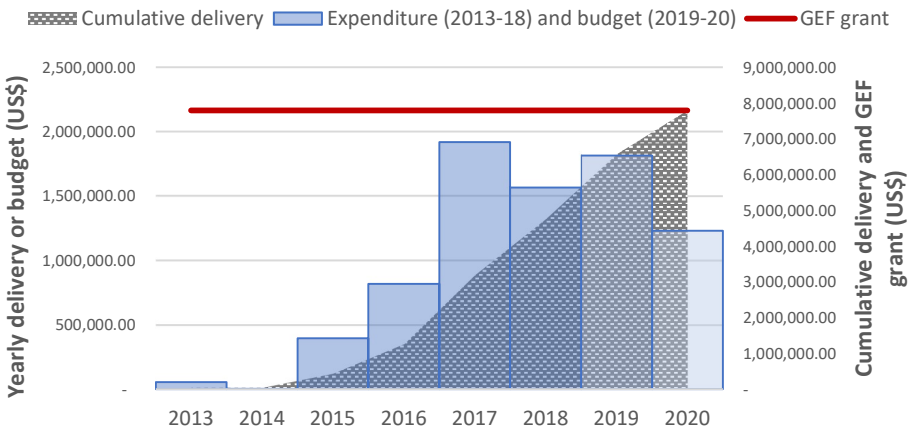
SUCRE was funded under the climate change focal area of the fourth GEF Resource Allocation Framework (RAF), with a grant of US$ 7,800,000 and co-financing amounting to US$ 62,608,900. Co-financing was redefined in the 2015 project revision as follows: the implementing agency, CNPEM-LNBR: 3,750,000 (6.3%), the Brazilian Sugarcane Industry Association (UNICA) US$ 100,000 (0.2%) and the participating sugar mills: US$ 55,800,000 (93.5%).

SUCRE has achieved 100% delivery on the GEF grant by June 2020 (table 1 and figure 1)[25], without any significant deviations from the AWPs.

Table 1. Budget delivery

Year	Expenditure (2013-20)	Cumulative delivery	% delivery
2013	55,593.	55,593.	0.01
2014	92.	55,686.	0.01
2015	396,423.	452,109.	0.06
2016	818,857.	1,270,967.	0.16
2017	1,917,564.	3,188,532.	0.41
2018	1,566,123.	4,754,655.	0.61
2019	1,813,823.	6,568,479.	0.84
2020	1,231,510.	**7,799,990.**	1.00

Figure 2. yearly and cumulative delivery



[25] (UNDP Brasil, 2015), (UNDP Brasil, 2016) (UNDP Brasil, 2017) (UNDP Brasil , 2018) (UNDP Brasil, 2019) (UNDP Brasil, 2020)

Co-finance

Participating mills have made investments to adjust their operations for optimal use of trash and cogeneration. These investments, including trash processing systems, and cogeneration equipment (boiler, turbines), are made in response to the mill's business plans and market environment forecast. In favorable conditions, if electricity prices are reasonable and equipment wear issues are contained, mills will likely keep on optimizing their operation, exporting more biomass energy, and mitigating further GHG emissions. The terminal evaluation considers these investments to be co-finance: while not all expenses are necessarily a direct consequence of the project's results, and not with the primary intention of reducing emissions, they demonstrate the viability of the project's solutions and strongly contribute to the project's objective.

Mill representatives did not disclose any information on investments during the TE interviews, citing confidentiality. However, they confirmed that investments were made to install trash processing equipment, enhancing collection and improvements in turbines and boilers. Information on investments is not disclosed in reports or other publications made available by the participating companies. The terminal evaluation can only use the information on investments on agricultural, dry cleaning, and co-generation equipment collected by the project. The project team gathered this information based on interviews and visits to the sites, verifying the type of equipment acquired and their estimated market price. This information was included in the 2019 MTR report. The MTR report estimates the total of co-financing investments by specific mills at US$ 151 million. This figure results from applying an exchange rate of 3.48 BRL/US$ to the project team estimate of BRL 528 million. 3.48 BRL/US$ approximates the mean 2016 exchange rate. It must be noted that the average annual exchange rate of US$ to Brazilian Real has changed significantly during the project implementation, from a lowest of 3.944 BRL/US$ in 2019 to 3.191 BRL/US$ in 2016.

Closer examination of the investment data reveals that only considering São Paulo (were the burning phaseout has been more consistent), participating sugar mills have invested an estimated total of BRL 422,611,576 in agricultural equipment for trash collection, dry cleaning equipment (sieves, crushers etc.) and co-generation equipment (boilers, turbines etc.). Using an average exchange rate of 3.52, the dollar estimate of total mill investment associated with the project would be of US$ 120 million, twice exceeding the expected amount (table 2A). This represents the lower and more restrictive estimate of mobilized co-funding. Co-generation equipment is the most expensive item, followed by trash processing equipment (table 2B)

Table 2A. Co-financing

	UNDP financing (US$m)		Private sector (US$n		Partner Agency (US$m)		Total (US$m)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants			55.90	120.01	3.75		56.65	120.01
Loans								
In-kind								-
Other								
Totals			55.90	120.01	3.75		56.65	120.01

Table 2B. Investments by mills located in São Paulo

Description	Estimated investment (BRL)
Co-generation equipment	313,000,000
Dry cleaning system equipment (sieve and crusher)	67,000,000
Agricultural equipment	28,611,576
Baling system	14,000,000
TOTAL	**422,611,576**

Monitoring and evaluation

Overall assessment of M&E (*)

SUCRE counted with a sufficiently funded, well-prepared monitoring and evaluation plan. SUCRE's M&E plan, including regular monitoring of data for the project's indicator framework and the midterm review and terminal evaluation was executed in a satisfactory manner. Moreover, the project managed a comprehensive database of results and data obtained from field experiments and other research activities that is still well maintained and available through the CNPEM-LNBR site.

Design at entry (*)

The project indicator framework contained 19 SMART indicators, closely linked to project actions. The project document included a very detailed M&E plan including the necessary reporting, midterm review and terminal evaluation with their corresponding budget allocation. The terminal evaluation rates the M&E system design as satisfactory.

Implementation (*)

Implementation of the monitoring and evaluation plan, including midterm review and terminal evaluation, as well as constant monitoring, database upkeeping and communication, including PIRs and dissemination of knowledge products was executed in a satisfactory manner.

Overall assessment of implementation/ oversight and execution (*)

SUCRE was designed and set to be implemented during the GEF-4 cycle, starting implementation in 2010. However, the change of status of the implementing agency, CTC made it ineligible to implement a GEF-funded project. Despite the prolonged dormant period of the project, its design was robust enough that when the UNPD undertook a substantive revision to update its results it effected virtually no other modification than the change of implementing agency.

UNDP implementation oversight (*)

The UNDP conducted its supervisory support in a highly satisfactory manner. UNDP's role included supervision and quality assurance of reporting, executing its corresponding part of the M&E plan, including hiring of external consultants for the midterm review and terminal evaluations. The UNDP provided regular assessments and ratings in the project implementation reports. Moreover, UNDP's role was critical in ensuring the success of the project through its pro-active engagement and search for alternative implementing partners. Hence, the terminal evaluation rates the UNDP implementation oversight as highly satisfactory.

Implementing Partner execution (*)

The CNPEM-LNBR has a well-established reputation within Brazil and internationally. CNPEM-LNBR-staffed project team was extremely competent both in their scientific and

technical qualification, and human quality needed to maintain the relationship with the partner mills, and successfully communicate findings in scientific, and industry related fora, workshops, and peer-reviewed papers.

CNPEM-LNBR has produced technical reports, papers and online tools of a remarkable quality and usefulness. Project reports, including PIRs were honest and adjusted to reality, acknowledging both successes and challenges, and including coherent ratings of the project performance.

The terminal evaluation rates the implementing partner execution as highly satisfactory.

Risk management

The project team and the UNDP satisfactorily reported on the project document risks in the PIRs. The identified risks were in general relevant, although some were very unlikely and were rather project assumptions as detailed in table 3.

Table 3. Risk table

Original risk	Mitigation strategy	Rating	TE findings
Technology for tra recovery not viable	Take into consideration C and mill's initiatives	Low	The risk was manifest in the challenges to determine optimal trash system. Well managed by the project
Trash recovery and use r economically viable	Reduce production costs	Low	
Fall of electricity prices	Reduce production costs	Low	Not a risk, but an assumption. A collapse in the energy market would have been catastrophic for the project. However, even in the event of a global pandemic, the energy prices have remained stable
Collapse of the sugarca industry	NA	Low	Not a risk, but an assumption. Absolutely unlikely. The sugarcane industry has survived a great recession, political crisis and global pandemic virtually unscathed.
Market factors make oth investments higher prior for mill owners	Engage energy serv company	Moderate	This risk has been absorbed by the participating mills that have made investments to adopt project solutions. Partner mills recognize that changes
Climate change impacts	NA	Low	The stability of the climate during the project implementation period was rather a project assumption
Environmental impacts sugarcane expansion	Monitoring and resear through project execution	Low	No issues, risk well-managed within the project strategy.
Soil fertility issues linked trash removal	Project strategy to ass agronomic effects of tra removal	Low	No issues, risk well-managed within the project strategy.

3.3 Project Results and Impacts

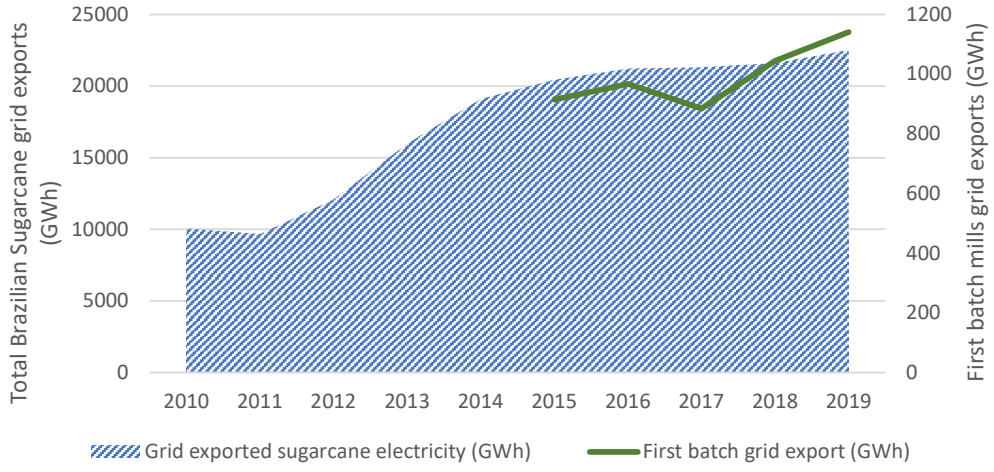
Overall project outcome (*)

SUCRE has accomplished or exceeded all the targets set in the project document. Excess sugarcane trash on fields, an unintended consequence of mechanical harvest, caused agronomic problems, contributed to agricultural emissions and was also an unused resource, which, if appropriately used could, and indeed can, contribute to achieve national mitigation targets.

SUCRE evaluated the economic, agronomic, environmental (including GHG emissions) and technical parameters (boiler corrosion and encrusting, transport costs efficiencies, etc.) of different methods of collecting, transporting and processing sugarcane trash for co-generation at mills. The results of trials and evaluations conducted by the project have been incorporated in a wealth of technical and scientific publications, which are publicly available, and specific technical reports for the partner mills.

SUCRE's ultimate goal was the avoid GHG emissions by catalyzing grid exports by at least six mills, reaching 300,000 MWh/year after five years of project implementation, avoiding the emission of 1.2 million tons of CO_2e. Grid exports from sugarcane mills have been growing steadily from 10 to 22.5 TWh between 2010 and 2019[26]. 12% or 2.74 TWh/year or the exported sugarcane-based power came from the 12 project partner mills. First batch sugar mills that have introduced project-supported solutions for co-generation were exporting 1.14 TWh/ year in 2019. During the project's implementation period, partner mills exported a total of 4.95 TWh, avoiding emissions of 2.4 Mt CO2e (compared with the same amount of energy produced in a gas-powered plant). First batch sugar mills are adopting project supported solutions to increase power generation without changing their total installed capacity by using sugarcane trash, at a faster pace than the ensemble of Brazilian mills (figure 3).

Figure 3. Growth of grid exports by sugarcane mills in Brazil (2010-2029)



[26] (UNICA, 2020)

Moreover, partner sugar mills have invested estimated US$ 120 million to improve trash collection and processing systems. Increase grid exports mean rising revenues and employment generation. 1,400 jobs could be generated in the wake of increased power exports. While the exact number has not been revealed, partner mill confirmed expanding their workforce linked to the additional co-generation capacities provided by availability of trash.

Ultimately, the amount of trash used, and the power exported the grid would depend on a variety of factors including the geographic location of the mill (climate, soil characteristics), price of alternative fuels, and more importantly, the electricity prices at the spot market. Yet, models developed by the project forecast revenue generation in most realistic combinations of energy prices, and agronomic and technical characteristics.

The project has not yet succeeded in have their recommendations for the energy market enacted into actual policy or regulatory instruments. However, SUCRE have indeed disseminated and promoted its results with the Ministry of Mines and Energy. However, the process of policy reform is not straightforward and dominated by political processes. A combination of political instability and the global COVID-19 pandemic have somehow stalled the project's lobbying in favor of more favorable rules that would encourage further increases of the renewable share of the national energy mix. This notwithstanding, the CNPEM-LBNR is committed to continue dissemination and promotion of SUCRE's recommendations with the ministries of Science, Technology and Innovation and Mines and Energy.

More importantly, trash-based co-generation and associated GHG emission mitigation is happening now and has very good chances of expanding to further mills, as the technical capacities and knowledge developed by the project disseminate.

In this regard, SUCRE has achieved a remarkable level of diffusion of the technical knowledge it generated. The project has made all publication and most data available through the CNPEM-LBNR webpage, including two tools, the straw calculator and the straw aptitude map that enable sugar industry operators to calculate potential revenues and agronomic impacts of trash collection, considering the location and dimensions of fields, capacity and actual sugarcane processing at the mill, and electricity prices.

Beyond that, SUCRE has rigorously examined the potential consequences of an expansion of sugarcane cultivation, concluding that sugarcane is expanding and will foreseeably expand over former pastureland, in fact increasing productivity and soil sequestration capacity.

All the above considered, the terminal evaluation rates the overall project outcome as highly satisfactory.

Relevance (*)

SUCRE supports Brazil's National Climate Change Policy and NDC pledge by avoiding emissions and increasing the share of non-hydro renewables in the national power mix. The project has contributed to Brazil's 2030 National Energy Plan (PNE 2030) which had the goal of increasing the diversification of the Brazilian energy mix and expanding the share of renewable energy sources. SUCRE is still relevant for the current 2050 National Energy Plan, which explicitly mentions utilization of sugarcane trash to drive expansion of biomass power generation[27].

SUCRE belongs under GEF-4's fourth strategic programming for climate change: Promoting Sustainable Energy Production from Biomass. The project strategy and results are aligned with the GEF-4 *Focal Area Climate Change Focal Area Strategy and Strategic Programming.* Namely, SUCRE directly supports the focal area's fourth objective: *To promote on-grid renewable energy*[28]. SUCRE directly contributed to the objective's indicators by increasing the market penetration of renewable energy and reducing GHG emissions from electricity generation.

SUCRE directly contributes to the Sustainable Development Goals (SDG) targets 7.2 and 7.3, increase substantially the share of renewable energy in the global energy mix and double the global rate of improvement in energy efficiency, by increasing the share of renewable energy and lowering Brazil's energy carbon intensity. UNDP's commitment with the 2030 agenda was expressed in its 2017-2021 country program document (CPD) prepared during the first year of project implementation. The CDP's third outcome[29]: *Strengthened institutional capacity to promote public policies for the sustainable management of natural resources and ecosystem services, and combating climate change and its adverse effects, and ensure the consistency and implementation of these* policies and output 3.1: *Policies strengthened for the adoption, implementation, and monitoring of mitigation and adaptation measures to climate change, mainstreaming and integrating national plans and international agreements*. SUCRE directly contributed to the outcome indicators mitigation of CO_2e emissions by avoiding the emission of at least 2 megatons.

Effectiveness (*)

Outcome 1. Technology for sugarcane trash collection and conversion to exported electricity at sugarcane mills is commercially launched.

The project team evaluated the agronomic, economic and emissions impact of trash collection through four different paths (integral harvesting, integral harvest with trash crushing, baling and hay harvester). The four first batch partner mills had already started trash collection prior to project start using hay harvesters, integral harvest and baling, together with dry cleaning systems to collect, transport and process sugarcane trash to ensure it could be mixed with sugarcane bagasse as fuel for co-generation.

[27] (MME and EPE, 2020)
[28] (GEF, 2007)
[29] UNDAF outcome involving UNDP (UNDP, 2016)

With data from the four first batch partner mills the project conducted a series of field experiments and developed models to develop technical solutions to minimize costs, emissions and agronomic impacts, as well as corrosion and damage to boiling and processing equipment.

The project produced comprehensive reports that were shared with the partner mills. The technical challenging and the potential costs of boiler damage had discouraged mills from expanding the use of trash as fuel for power generation. Yet, all four first batch mills and one second batch mill are burning trash for co-generation, using systems based on solutions developed by the project team. The first batch four partner mills have a combined milling capacity of 20 million tons of sugarcane per season and a power installed capacity of 295 MW. In 2015, those mills were exporting 0.97 TWh of mostly bagasse-fueled power to the grid. Without expanding their installed capacity and by optimizing the use of sugarcane trash, their combined exports reached 1.14 TWh by 2019 (table 4). Based on a Life Cycle Assessment under ISO 14040 and ISO 14044 approach, considering the ReCiPe Midpoint method, the project estimates that, on average, sugarcane-powered electricity causes emissions of 0.07 $KgCO_2e$ per KWh. This includes agricultural N_2O emissions and CO_2 emissions by diesel-powered agricultural, transport and processing machinery. To compare with the equivalent average emissions from gas-powered plants, we use Ecoinvent's database estimate of 0.55 $KgCO_2e$/KWh. Thus, with a total of 4.95 TWh exported by first batch sugar mills between 2015 and 2019, 2.38 $MtCO_2e$ would have been avoided.

Table 4. Grid exports by first batch sugar mills*.

Mill	Installed capacity (MW)	Estimated basline Base scenario (no trash collection) (MWh/year)	2015 (MWh/year)	2016 (MWh/year)	2017 (MWh/year)	2018 (MWh/year)	2019 (MWh/year)	Estimated export with optimized trash use (lower estimate) (MWh/year)
1	97	202,955	149,437	149,437	200,565	200,565	213,607	213,607
2	70	309,364	308,603	308,603	337,105	337,100	337,100	337,105
3	58	87,600	87,793	89,793	87,600	87,600	87,600	160,900
4	70	368,700	368,700	418,616	259,571	418,616	501,800	522,800
TOTAL	**295**	**968,619**	**914,533**	**966,449**	**884,841**	**1,043,881**	**1,140,107**	
					2015-2019 total:		**4,949,811**	
	0.07	kg CO2eq/kWh	GHG emissions sugarcane electricity			Total emissions	346,486.77	tCO2eq
	0.55	kg CO2eq/kWh	GHG emissions gas-powered plant			Gas emissions	2,722,396.05	tCO2eq
	0.48	kg CO2eq/kWh	Difference			Avoided emissions	2,375,909.28	tCO2eq

*Compiled by the terminal evaluation with data from[30]

The project also modelled and projected co-generation and technical and environmental impacts from trash utilization at all the 12 (batches 1 and 2) partner mills. Those 12 mills were exporting

[30] (Project BRA/10/G31 – PIMS 3515, 2016), (Project BRA/10/G31 – PIMS 3515, 2016), (Project BRA/10/G31 – PIMS 3515, 2018), (Project BRA/10/G31 – PIMS 3515, 2020), (Project BRA/10/G31 – PIMS 3515, 2018), (Project BRA/10/G31 – PIMS 3515, 2016), (Project BRA/10/G31 – PIMS 3515, 2018), (Project BRA/10/G31 – PIMS 3515, 2019), (Project BRA/10/G31 – PIMS 3515, 2020), (Project BRA/10/G31 – PIMS 3515, 2019), (Project BRA/10/G31 – PIMS 3515, 2018), (Project BRA/10/G31 – PIMS 3515, 2018)

2.8 TWh in 2019 and could potentially reach 3.2 TWh by adopting project solutions, without needing to increase their installed capacity (table 5).

Table 5. Exports and possibilities of batch 1 and 2 sugar mills

Mill	Elec.Exp.2019 (MWh/year)	Optimal trash use export lowe estimate (MWh/year)	Optimal trash use export highe estimate (MWh/year)
1	314,793	358,555	404,855
2	541,408	564,182	592,715
3	129,762	160,597	160,597
4	276,547	276,547	302,616
5	97,040	110,245	115,516
6	149,330	170,936	184,106
7	85,222	127,139	127,144
8	40,000	68,786	79,743
9	213,607	213,607	213,607
10	337,100	337,105	337,105
11	87,600	160,900	166,000
12	501,800	522,800	522,800
Total	**2,774,209**	**3,071,399**	**3,206,804**

Outcome 2. Economic and financial viability of sugarcane trash collection and utilization for export of electricity from sugarcane mills is commercially demonstrated.

The key outputs for this outcome was the collection of relevant parameters, including electricity prices, distance of trash recovery, diesel prices, bagasse costs, trash collection costs, etc. from the partner mills. Based on the data provided, the project developed customized models and scenarios to evaluate the economic performance of trash use for co-generation.

The results show that actual revenues from trash use for co-generation depend on several factors including climate (determining harvest and amount of trash available), demand for sugar products (energy and non-energy), but mostly, power prices. The project's models and technical reports delivered to the partner mill demonstrated that there are combinations of operational and market parameters that would make trash collection and use profitable even for those mills that are presently reluctant to use trash for co-generation.

The financial viability for the four partner mills that have adopted project-developed solutions has been made evident by the over US$ 120 million invested by those mills in installing and operating the necessary equipment and manpower.

Outcome 3. Environmental integrity of the use of biomass energy is assured.

Outcome three intended to establish the environmental effects of sugarcane and trash use. The key outputs for this outcome where the production of guidelines on the effects of trash removal on soil quality, erosion and pest control, the determination of the mitigation potential of trash use in co-generation, and disclosure of impacts of sugarcane cultivation on natural ecosystems.

The project produced trash removal guidelines that enable operators to determine optimal levels of trash removal. Results demonstrated that over half of the trash production can be removed for use in co-generation without any detrimental agronomic effects.

These guidelines took the different locations, aspects, and soil characteristics of fields and were compiled using the results of over 30 rigorous field experiments conducted in partnership with participating mills over the five years of project implementation.

The project reports that partner mills are exporting 1.14 TWh biomass-generated power to the grid (1.6% of Brazil's total power generation in 2019)[31]. The International Energy Agency confirms the rise in biomass power generation in Brazil from 49.5 TWh in 2015 to 54.5 TWh in 2019. UNICA estimates that in 2019, Brazilian sugar mills exported 22.5 TWh of electricity. The sugar mills interviewed for the terminal evaluation confirm that the use of trash has significantly increased their co-generation capacity. The project estimates that using 50% of trash at all co-generating mill could rise sugarcane power exports to 101 or even 141 TWh. The latter estimate assumes expansion of sugarcane cultivation by 3 million hectares to meet RenovaBio's ethanol production goals. Assuming an annual growth of 2.5% of power generation[32], 141 TWh would mean nearly 20% of Brazil's 2025 power output.

The project conducted a comprehensive research on impacts of sugarcane expansion over natural ecosystems based on satellite imagery. The Brazilian sugarcane industry has shared the unsavory, but not necessarily true, reputation of other agricultural activities in Brazil for their alleged impacts in the destruction of the fragile biomes of Amazonia, Cerrado and Pantanal. The project demonstrated that the recent expansion of sugarcane cultivation has occurred over pastureland and former annual crops areas, thus not directly contributing to deforestation or forest degradation. Moreover, even in the event of further expansion, e.g. linked to the Union's program to boost bioethanol production (RenovaBio), SUCRE determined that there are at least over 200,000 km^2 of available land for expansion just in the South-Center region, without impacting natural forest or Cerrado vegetation.

Outcome 4. Dissemination, Capacity Building, and Replication Strategy Across the Sugar Industry is under implementation.

Under this outcome, all results from the previous three was compiled, packaged and disseminated. Key outputs were peer reviewed papers, presentation on relevant international and national fora, and tools and data published.

[31] (International Energy Agency (IEA), 2020)
[32] Based on trend since 2015 with data from (International Energy Agency (IEA), 2020). Years prior to 2015 severely affected by 2014 political crisis and 2008 recession.

The project has produced 14 scientific articles that have been published in peer reviewed journals or conference proceedings. SUCRE has participated in international conferences on biomass energy, where it presented its work and results. SUCRE was also featured in a report by the United Nations Office for South-South Cooperation and the Center for Strategic Studies and Management presented at the COP 25 in Madrid, about the potential for replication in other countries with sugarcane cultivation.

All the technical guidelines and results outlined under the previous three outcomes were compiled in technical reports and booklets published in Portuguese and English and available at the project web at the CNPEM-LNBR site: https://lnbr.cnpem.br/sucre-project/.

The economic and the geographical models (Straw calculator and Straw Aptitude Map) to evaluate trash removal developed by the project are also available at the same site as open access resources.

The CNPEM-LNBR has undoubtedly used its links to the sugarcane and biomass industries in Brazil and elsewhere, academia, and international research institutes to deploy a very effective communication and dissemination strategy of its high quality, scientific and knowledge products.

Outcome 5. Institutional, legal, regulatory framework is in place to promote the sustainable use of biomass for electricity generation and sales to the grid.

Under this outcome, the project strategy expected the project to "interact with government in pursuit of regulatory change" resulting in actual "regulatory changes to support trash utilization for electricity generation". This supposes a serious underestimation of the challenges involved in pushing the approval of a policy reform.

The Brazilian energy market is mature, established and well regulated. It is being supervised by very powerful institutions that include the Brazilian Energy Agency (ANEEL), the National Energy Research Office (EPE) and the Ministry of Energy and Mines (MME). The fact that biomass power generation was and is not the biggest nor the fastest growing share of the Brazilian power mix, and that the feasibility of trash use for co-generation was not yet established at a commercial scale did not support the inclusion of these powerful institutions in the project government structures.

Instead, SUCRE first conducted the pertinent analyses of the feasibility of trash use for co-generation and the actual conditions of the energy market. The project produced knowledge materials and recommendations for optimizing the energy market to encourage entry by independent biomass-based producers. These recommendations were shared with and industry operators through the sugarcane industry association UNICA. Moreover, the project team reached out to the MME to promote said recommendations. As a result, SUCRE's recommendations are among several new proposals submitted to the Brazilian Federal Congress that are currently being discussed in the frame of a reform of the energy regulatory framework. It is expected that the reforms will favor independent power producers, such as the sugar mills, facilitating grid exports.

Table 5. Progress towards project targets

Indicator	Target	Reported progress to date
Objective: to create the conditions for sugar mills to increase the export of electricity generated by sugarcane trash and bagasse		
Trash system implemented and operating	Trash system successfully operating in 3 mills	Trash collection and processing system installed in four partner mills
Increase in exports of biomass-based electricity to the grid	180,000 MWh/yr exported to the grid by mills 1, 2, and 3 at end of project	Four partner mills exporting together to the grid on average 1.14 TWh of electricity
Economic feasibility of increased generation with trash is demonstrated	The share of revenues from electricity generation increases in proportion to sugar and ethanol in 3 mills	Trash-based power generation simulated to be profitable in most conditions. 4 partner mills have increased electricity grid exports
Trash system replicated across the sugar sector	Investment leveraged for installation of trash system in at least one additional mill by end of project	Partner mills have adopted technical recommendations for the project team regarding trash collection, processing and burning and have invested more than US$ 160 million in equipment related to the production of electricity since 2015.
Environmental and legal framework in place for electricity generation with bagasse	Clear, streamlined environmental guidelines and procedures for generation with sugarcane trash	The project has produced clear guidelines that enable operators to calculate environmental (GHG mitigation, soil quality, pest) and economic impacts of trash removal and use for co-generation.er exports being discussed at Congress
	Well defined regulatory framework for generation with sugarcane trash	Analysis and recommendations of the energy market rules to incentivize electricity export by sugar mills have been shared and disseminated
Information disseminated on project results and the benefits of generation with sugarcane trash	Clear guidelines, procedures, and demonstrated benefits of generation with sugarcane trash are published and disseminated	Technical reports, papers, models and guidelines disseminated at workshops, peer reviewed journal, industry conferences and COP 25

Indicator	Target	Reported progress to date
Outcome 1: Technology for sugarcane trash collection and conversion to exported electricity at sugarcane mills is commercially launched.		
Trash collection system design finalized and operational	Methodology defined and being used	The project evaluated different collection and processing systems to optimize content, composition and particle size to boiler characteristics
	Final design implemented and operational in mill #1	All four partner mills from batch 1 have installed and operate trash collection and processing systems based on project developed solutions
Generation of electricity from trash at mill #1	Sale of additional 60,000 MWh/year of electricity (from mill #1) after three years.	The first partner mill was able to increase its exports to the grid by 89,212 MWh/ year on average over the five years of the implementation timeframe of the project
Outcome 2: Technology for sugarcane trash collection and conversion to exported electricity at sugarcane mills is commercially launched.		
Economic feasibility is fully assessed prior to investment	Economic feasibility demonstrated for use of trash to make exportable electricity at mills #1, #2, and #3.	Economic viability studies for all four partner mills of batch 1 where finished and delivered. Simulations using project-developed models show that trash use for co-generation can generate revenue under most usual conditions. However, actual revenues were not revealed and depend mostly on energy prices
	70 % increase in sale of electricity at mills #1, #2, and #3 due to inclusion of additional sugarcane trash	
Guidelines for environmentally acceptable trash utilization completed and distributed	Guidelines completed and in use	Based on 30 field experiments conducted over the five years of project implementation, the project team was able to develop and disseminate guidelines and calculations for impacts of trash removal on erosion, soil fertility and pest abundances for different climate and field conditions. This work is being presented at the 28th European Biomass Conference and Exhibition, with over 1,500 participants from 87 countries

Indicator	Target	Reported progress to date
Outcome 3: Environmental integrity of the use of biomass for energy is assured.		
Reduction of net GHG emissions associated with additional electricity generation verified based on actual operating data from mills #1, #2, and #3.	Quantitative understanding of potential net GHG reductions from use of trash for electricity generation.	Project-developed solutions have directly contributed to the mitigation of 2 million tons of CO2. This is calculated based on the emissions that would have been produced on a gas-powered plant by the generation of the electricity exported to the grid thanks to the project solution by the four partner mills of batch 1.
	Sector wide analysis of CDM potential for enhanced trash use.	Using 50% of sugarcane trash produced by the sugarcane industry in Brazil, together with bagasse, biomass co-generation can attain 100 TWh/year, equivalent to 80% of the domestic sector demand in Brazil.
Sugarcane expansion clearly demonstrated as having minimal impact on deforestation rates in Brazil	Specific assessment conducted to demonstrate the potential impacts on deforestation	The project evaluated the impacts of the expansion of sugarcane cultivation from 2002 to 2016. Results show that sugarcane expansion occurs mostly over former pastureland with merely 4% having occupied natural forest area. The project produced estimations of about 20 million hectares available for sugarcane expansion over cropland and pastureland avoiding deforestation.
Additional removal of trash for electricity generation demonstrated to have negligible detrimental impact on soil	Project assessment conducted to further assess impact of trash removal on soil quality	Project researched and published results on how trash removal affects soil quality for a variety of climates and soil conditions.

Indicator	Target	Reported progress to date
Outcome 4: Dissemination, capacity building, replication strategy across the sugar cane sector is under implementation		
Guidelines issued for general pre-feasibility assessment in sugar mills	Clear, streamlined guidelines and procedures for assessing potential benefits of additional generation with sugarcane trash	Project team adapted a tool to simulate agronomic impacts, economic viability and environmental benefits of the collection and use of trash for bioelectricity purposes Project team assessed socioeconomic impacts derived from biomass-based electricity in comparison to natural gas showing that for 1 TWh of electricity generated using sugarcane biomass it is possible to create 1400 more jobs than if this amount of electricity were generated using natural gas.
Feasibility studies and basic engineering of 7 mills (beyond the first three) interested in installing the trash system completed	Guidelines for general pre-feasibility assessment of trash utilization	Technical reports delivered to each one of the eight partners evaluated considering the particular operational conditions (when provided by the partner) and market interests to guide decisions regarding trash use for electricity production.
	Feasibility studies for 7 mills (beyond the first three) completed	
Sale of additional 120,000 MWh/yr (from mills #2, and #3) after five years	Generation of electricity from trash at mill #2 and #3	Mills of Batch 1 are exporting to the grid more than 1 TWh every year.
Mill #4 invests in electricity generation with bagasse	Funding is leveraged from mill #4 to implement generation of electricity with trash.	Investment in the Dry-Cleaning Systems, auxiliary equipment for trash collection and co-generation equipment is estimated at US$ 120 million.
Expressions of interest (contracted studies, letters of interest, participation at seminars, phone inquiries, etc.) from companies in trash-electricity, indicating market transformation.	Clear demonstration of interest by 7 additional mills in investing in additional electricity generation with trash	Partner mills from Batch 1 and 2 already invested at least US$ 120 million in equipment related to biomass-based electricity generation. Moreover, the major portion of Batch 2 mills are already producing and exporting electricity to grid.

Indicator	Target	Reported progress to date
Outcome 5: Dissemination, capacity building, replication strategy across the sugar cane sector is under implementation		
Mutually beneficial regulations fostering increased electricity generation with sugarcane trash are implemented	Full knowledge of relevant legislation regulating the electricity sector in Brazil is obtained, including potential solutions to address remaining barriers for generation with trash	Project and UNICA have promoted adjustments in the legal and regulatory framework of the electric sector in order to promote the production and sale of biomass-based electricity through knowledge products (informative booklets) and concrete suggestions for reforms in the legal and regulatory framework.
	Meetings conducted with relevant state entities to discuss new regulatory framework that addresses sugarcane industry trash-to-electricity issues and barriers	Meetings conducted with MME and other relevant partners
	Mutually beneficial regulatory reforms agreed between regulating entities and the sugar sector	Political changes during the project's implementation have not favored interaction with regulatory bodies. The LNBR will ensure that the recommendations formulated by the project will be further discussed with the support of the MCTI

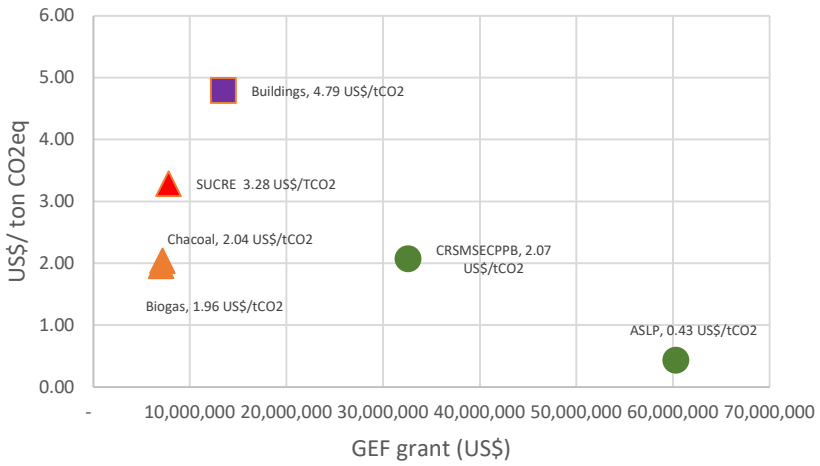
Efficiency (*)

The project strategy was efficient and mitigation costs in line with similar projects. SUCRE avoided the emission of at least 2 million tons CO2e during its implementation period. Considering just the GEF grant of US$ 7,800,000 means an average of US$ 3.90 per ton of CO2e. This puts it in line with other climate change focal area projects implemented in Brazil. While ecosystem-based projects are in general the cheapest option for mitigation, SUCRE does not seem to significantly differ from other renewable projects (table 6).

The project non-cost extension of six months did not affect its efficiency in any significant manner, i.e. did not significantly increase its management costs. Taken into account that the project has exceeded its targets with the resources planned, the terminal evaluation rates the project's efficiency as highly satisfactory.

Table 6. Comparison of mitigation cost across climate change focal area projects in Brazil[33]

Title	Focal Area	GEF Agency	Project Type	Approval Date	Method	Mitigation costs (US$/tCO2)
SUCRE	CC	UNDP	FP	28/07/08	Renewables	3.28
Market Transformation for Energy Efficiency in Buildings	CC	IADB	FP	14/06/07	Efficiency	4.79
Biogas Applications for the Brazilian Agro-industry	CC	UNIDO	FP	04/05/17	Renewables	1.96
Production of Sustainable, Renewable Biomass-based Charcoal for the Iron and steel Industry	CC	UNDP	FP	23/01/14	Renewables	2.04
Amazon Sustainable Landscapes Project	CC, Bio, LD	World Bank	FP	21/08/17	Ecosystems	0.43
Conservation, Restoration and Sustainable Management Strategies to Enhance Caatinga, Pampa and Pantanal Biodiversity	Bio, CC	IADB	FP	08/08/17	Ecosystems	2.07



[33] (GEF, 2020)

Sustainability

Overall likelihood of sustainability (*)

SUCRE's results are very likely to be sustainable in the midterm. The investment made by partner mills, the institutional support to bioethanol production through RenovaBio and the alignment with the national mitigation goals all point to not just sustainability, but an expansion of the results attained so far. Moreover, the project implementing partner, CNPEM-LNBR is a key institutional research institute with total official support which will continue to support and promote mitigation through biomass co-generation.

Financial sustainability (*)

For the partner mills, financial sustainability will depend ultimately on the evolution of electricity prices. Yet, given the investment of US$ 120 million, it is clear that they have decisively bet for the future of trash as fuel for biomass co-generation.

The future of the CNPEM-LNBR is indeed assured as key part of the national institutional research infrastructure.

Socio-political sustainability (*)

Mills are committed to continue using trash even if there are still pending challenges related to trash collection and transport cost and some damage to boilers to take into consideration, participating mills manifest their intention of continuing developing and even expanding co-generation using trash as fuel.

Increased co-generation and export to the grid has also helped the industry to expand its workforce. However, it is yet unclear how the current COVID-19 pandemic would be affecting the sugar industry through impacts on the workforce and changes in demand for energy products. Notwithstanding, the commitment of the Federal Government with the promotion of bioethanol through its flagship program RenovaBio, and indeed through the support to bio-solutions through the CNPEM makes a drastic fall in demand affecting project results unlikely.

Moreover, expansion of project-developed solutions in the Central-South region is indeed likely. Unfortunately, the lack of conditions for mechanical harvest in the Northeastern regions mean that this particular set of solutions cannot be exported there.

Institutional framework and governance (*)

There are no institutional risks menacing the sustainability of project results. In fact, there is some likelihood that the energy market regulations be reformed to incentivize independent power producers, such as the project's partner mills.

Environmental sustainability (*)

There are no serious environmental risks to the project results.

Most sugarcane cultivation takes place in deeply humanized landscapes, where this kind of cultivation has been present over centuries. Moreover, SUCRE has demonstrated that the current expansion of sugarcane harvested area has not affected natural ecosystems, but that there are up to 200,000 km^2 of available land for further expansion.

Climate change may indeed have some effect on sugarcane cultivation. However, projections indicate rather an increase in rainfall and temperature for the Central-South region, which would not affect, but rather favor sugarcane culture. However, the effect of further aridification in the Northeast may have devastating consequences for their sugarcane industry.

Country Ownership

The project was developed jointly by non-profit sugarcane industry agents (CTC, UNICA) in coordination with government agencies (MCTI), based on the results of the implementation of two previous GEF-funded projects in Brazil. These projects demonstrated the viability of enhancing biomass co-generation at mills using sugarcane trash, a by-product of a ban on pre-harvest burning and subsequent mechanization. Government institutions were represented in the project board and the implementing agency is one of the leading research institutions of the Brazilian government.

Gender equality and women's empowerment

The project document was "gender blind": it did not consider any gender aspect nor foresee any actions to promote women empowerment. Despite the lack of explicit gender plan, the implementing agency produced an assessment of differentiated employment impacts on men and women of energy generation from biomass.

While technical and management positions in the sugar industry appear to be dominated by men, this is not due to any explicit barrier, but rather with historical inertia. However, there are women in charge of the agricultural or engineering sections of some mills, as well as in high government positions, including SUCRE's project manager.

Cross-cutting issues

SUCRE included broader development impacts: Expansion of employment opportunities in harvesting, collecting and using trash for electricity was one of the explicit expected impacts of the project. During the project design stage, the sugarcane industry was experiencing a relative decline, causing a fall in employment generation[34]. However, the situation has been reversed since the launching of National Policy on Biofuels (RenovaBio) in 2017, which has boosted production and employment.

Phasing out preharvest burning and the consequent mechanical harvest did indeed cost many agricultural jobs, but the total income lost has been compensated by the generation of higher paying jobs associated with industrial processes and administration[35]. The sugar industry is still a very important employer, at the regional and national level. 3.2% of the total employment in agriculture of Brazil (over a million people) works at the sugarcane industry. But, against the common informality of the sector where just 36% of the employees have a signed contract, up to 95% of the jobs linked to the sugar mills are formal[36].

By project estimations, 1.14 TWh of electricity generated using sugarcane biomass can create 1400 additional employments, compared to gas-generated power. Participating mills interviewed for the terminal evaluation confirm that increasing co-generation and grid export has contributed to generating additional formal employment.

The project was designed to be implemented in the most important sugar producing region of Brazil: The Central South region. However, the project made efforts and succeeded in including a further partner mill from the Northeastern region (state of Alagoas).

The Central-South region is the most affluent region of Brazil, with the best values of human development indicators and per-capita income. While of much lesser scale of sugar production, the Northeastern region includes some of the more economically depressed states of the union, like the states Alagoas, Pernambuco and Paraíba that have a significant sugar industry. The geographic reality of these states, where fields are located in slopes steeper than 12%, prevents the use of conventional mechanical harvest. Thus, manual harvest and pre-harvest burning will continue to be practiced, notwithstanding the harmful effects for human health, GHG emissions and the low paying, seasonal character of the associated jobs.

GEF additionality

The project outcomes match GEF's environmental, regulatory, financial, and innovation additionality criteria.

Trash collection using technical solutions developed by the project's test has helped increase co-generation and avoid 2.38 million tons of CO_2e annually. The project has formulated policy recommendations that are being promoted and could be enacted into the regulatory framework. The project's recommendations would make easier for IPPs to export their surplus co-generated renewable energy and thus enhance mitigation of GHG emissions.

[34] (Barros, et al., 2018)
[35] (Barros, et al., 2018)
[36] (World Bank, 2017)

As it will be described in the next section, there is some likelihood of the project concept and solution being exported to other sugar-producing countries, which may also contribute to avoid territorial GHG emissions there by increasing the renewable share in their power mix.

Finally, SUCRE has contributed to the generation of quality employment through the deployment of innovative technical solutions that have permitted the expansion of the installed capacity of renewable energy in Brazil.

Catalytic/ Replication effect

SUCRE has the potential for significant sustainable transformation of the sugarcane sector worldwide, promoting green harvest, using "trash" and generating renewable electricity, and contributing to NDCs and SDG targets. The project-developed solutions have the potential to expand to some of the over 80 countries where sugarcane is grown. This offers opportunities for South-South cooperation, as Brazil is viewed internationally as a leader in technological innovation and competitiveness in the sugarcane processing industries.

In this regard, the project has already engaged with counterparts in Argentina, Colombia, Cuba, Guatemala, and Mauritius, South Africa, and Thailand[37] which have shown interest in the project following dissemination of project results by the participation and mentions of the project in international congresses and even the COP 25 in Madrid. The CNPEM-LNBR intended to enhance the dissemination of the project's tools and results throughout 2020 by participating in several workshops and congresses. However, the COVID-19 outbreak prevented the participation and dissemination of products. Yet, and while the project is already operationally closed, the CNPEM-LNBR has not stopped facilitating the replication of SUCRE's experience. There is increasing interest in cogeneration and the use of sugarcane trash. For example, the Centro de Investigación de la Caña de Azucar de Colombia (CENICAÑA) funds a seminar imparted by CNPEM-LNBR staff on trash use for cogeneration later this year. A further possibility for this kind of South-South cooperation lies in the interest manifested by the Guatemalan Sugarcane Research Center (CENGICAÑA) in applying lessons from SUCRE in their industry.

While the success of this project in mitigating emissions by enhancing electricity generation from renewable sources, it must be remembered that the key for said success is the quality and integrity of the implementing agency, a well-structured, and staffed government research organization and the robustness of Brazilian institutions, including the energy market that provided the necessary conditions even in a period marked by recession and political crisis.

Such remarkable conditions are not present in most countries susceptible of receiving GEF support. In fact, across the region and the world, several GEF-4 renewable energy project, including in Brazil, were cancelled, due to, at least partially, the challenges involved in managing project of such technical and implementation complexity, involving numerous private sector and government actors.

[37] **Invalid source specified.**

Progress to impact

Environmental stress reduction (e.g. GHG emission reduction, reduction of waste discharge, etc.)

SUCRE's biggest environmental contribution has been the mitigation of over 2 million tons CO_2e. More importantly, SUCRE's findings have paved the way for an expansion of biomass power generation. There are currently around 200 mills selling surplus electricity to the national grid and, in consultation with several stakeholders of the sugar sector, the SUCRE team estimated that between 60 and 70 of them are collecting and using trash to supplement bagasse. In 2010, 140 mills exported electricity, without collecting or processing sugarcane trash, except for the amounts accidentally collected with the sugarcane bills. As the project started implementation in 2015, there were at least four mills that had begun to experiment with trash collection and processing (including three of the project's first batch partner mills).

In this regards SUCRE has also accounted and evaluated the optimal quantity of trash that can be removed for different field characteristics and locations, to avoid causing erosion or losses of soil fertility that would need a more intense use of fertilization.

SUCRE has also been able to demonstrate that sugarcane cultivation and potential expansion of area harvested would not have any detrimental consequences for threatened ecosystems. Considering that expansion of sugarcane cultivation over the last 25 years has extended over less than 60,000 km^2 and the project finding that there are over 200,000 km^2 available degraded pastureland and annual crops over which sugarcane could reasonably expand, direct pressure from sugarcane on natural forest, least the delicate biomes of Amazonia and Pantanal is very unlikely. Moreover, no evidence of indirect impact on natural forest or Cerrado vegetation by displacement of pastures or other crops was found.

Environmental status change.

By demonstrating the feasibility of trash use and additional generation of revenue at industrial scale, SUCRE has helped to consolidate mechanical harvest as not only the most environmentally and human health-friendly method. Reversal of the preharvest burning ban is out of the table as there is absolutely no interest by regulators nor demands by producers, for which mechanical harvest and associated co-generation constitutes a more efficient, and profitable process, which is also linked to the generation of quality employment.

While SUCRE engaged with one partner mill in the Northeastern region, the physiognomy of the northeastern sugarcane fields does not allow for introduction of mechanical harvest and hence a phase-out of preharvest burning. Significantly behind in human development compared to the relatively affluent Central-South region, the Northeastern states will continue to allow manual harvest, an important, albeit seasonal source of employment, and associated preharvest burning.

4. Conclusions, Recommendations, Lessons Learned

4.1 Conclusions

SUCRE has been a real success. The project has exceeded expectations and achieved or exceeded all its targets, failing merely to force the adoption of policy recommendation, which was far beyond the actual possibilities of the implementing agency, the UNDP or any government agency. Policy reforms have complex political procedures that make them unsuitable to be commitments to be fulfilled by a project of this characteristics. Even here, the project has made very important efforts, succeeding in preparing solid recommendations that are currently being considered by the Brazilian congress in the frame of a wider reform move of the energy market regulations.

The execution of the project has been extremely professional and robust. The CNPEM-LNBR has acted as an efficient responsible partner and administered the project implementation with remarkable effectiveness, with solid support from the UNDP, even in the face of implementation challenges.

SUCRE has succeeded in truly mobilizing and committing important sugarcane industry operators to invest significant sums in adopting trash collection and process systems which have resulted in actual mitigation of GHG emissions, which could likely be expanded, boosting biomass power generation and the share of non-hydro renewable sources in the Brazilian energy mix. Hence, the project has achieved a truly catalyzing effect, helping to mainstream the use of a so far neglected resource by developing technical solution that can be now left to market forces.

SUCRE has also accounted for environmental and social impacts of its actions. On the first topic, SUCRE has ensured that the sugarcane industry is not a net contributor to deforestation. On the second, SUCRE has highlighted the possibilities of generation of quality jobs by supporting the renewable energy sector.

4.2 Recommendations

UNDP and CNPEM-LNBR should continue to promote and disseminate the scientific papers and knowledge products generated by the project, including by reaching out again to the MCTI and MME.

UNDP and CNPEM should consider the design of a project with GEF or Green Climate Fund support to further support enhancement of the biomass generated power, considering its lack of negative externalities and alignment with the NDC target. Dimensions to be explored include support to development of second-generation biofuels, substitution of fossil fuels in harvest and transport operation of sugar mills and management of vinasse fertigation (the latter to reduce soil emissions and improve fertilizer management).

UNDP should identify partners to design a project to support development of solutions for mechanical harvest and biomass co-generation in the Northeast of Brazil. The Northeast is

a relatively depressed region within the Brazilian union, where so far only manual harvest of sugarcane, with the necessary pre-harvest burning is possible. As the northeastern sugarcane industry operators do not seem to be able to develop solutions on their own, the catalytic effect of SUCRE in the Central-West region could be replicated by co-developing a solution that would enable mechanical harvest in steeper terrain.

At regional level, both for Latin America and Asia UNDP should strive to identify suitable implementation agencies, in the model of CNPEM-LNBR (responsible-partner type execution) to replicate SUCRE's support to biomass generation. Priority countries could be Cuba and Argentina in Latin America and Thailand and the Philippines in Asia, which are not far behind Brazil in institutional and human development.

4.3 Lessons learned

Supporting biomass generation is an effective and efficient path to achieve mitigation targets in countries with an establish sugarcane industry. Necessary conditions for success are a dynamic and professional implementing agency with the necessary technical and financial capacities, as well as a degree of institutional robustness, e.g. where there are certain guarantees of enforcement of property rights (including intellectual property) and accountability for environmental externalities. In the case of SUCRE, the project could not have been successful if not for the implementation of the agro-ecological zoning and the preharvest burn ban.

It is paramount to include accountability for social and environmental externalities of private or public actors supported by a GEF project. In the case of SUCRE, the positive externalities of biomass generation using trash have been pointedly researched and documented.

Policy reforms follow complex political procedures that make them unsuitable as commitments to be fulfilled within a project's implementation period. Should reforms be a necessary target, then a project should need to incorporate the relevant agencies (e.g., industry regulators, line ministries, members of parliament, etc.). In this project however, such complex management arrangements would have been to the detriment of the technical results achieved.

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29th May 2020.

INTERNATIONAL IC CONSULTANT - UNDP BRAZIL

Terminal Evaluation

GEF

Please find enclosed Terms of Reference and Evaluation Criteria for a Selection Process of an IC - Individual Contractor to hire a consultant for GEF.

The Procurement Unit of UNDP Office in Brazil would appreciate receiving technical and financial proposals for the above-mentioned selection.

The submission of **technical proposal (CV)** and **financial proposal (Annex I Price)**, in separate files, should reach the e-mail

ic.procurement.br@undp.org no later than **5th June 2020**.

Only complete applications that meet the aforementioned requirements will be considered. Applications received after the deadline will not be accepted.

The Financial proposal duly signed should be sent in a separate PDF file. All presented documents must carry the identification on the name of the file and subject fields as:

"IC 34296/2020 – GEF Terminal Evaluation"

If you request any additional information it will be provided by e-mail ic.procurement.br@undp.org

*** Proposals sent to any different e-mail than the one indicated (ic.procurement.br@undp.org) or copied to different e-mails will not be accepted for the selection.**

IC Selection Team
Procurement Unit
UNDP Brazil
ic.procurement.br@undp.org

OFFEROR'S LETTER TO UNDP
CONFIRMING INTEREST AND AVAILABILITY
FOR THE INDIVIDUAL CONTRACTOR (IC) ASSIGNMENT

Date _____

To
Mrs. Katyna Argueta – Resident Representative
United Nations Development Programme – UNDP Brazil
Setor de Embaixadas Norte (SEN) Quadra 802 – Conjunto C – Lote 17
CEP 70800-400 – Brasília, DF

I hereby declare that :

a) I have read, understood and hereby accept the Terms of Reference describing the duties and responsibilities of [*indicate title of assignment*] under the [*state project title*];

b) I have also read, understood and hereby accept UNDP's General Conditions of Contract for the Services of the Individual Contractors;

c) I hereby propose my services and I confirm my interest in performing the assignment through the submission of my CV or Personal History Form (P11) which I have duly signed and attached hereto as Annex 1;

d) I hereby propose to complete the services based on the following payment rate:

☐ A total lump sum of [*state amount in words and in numbers, indicating exact currency]*, payable in the manner described in the Terms of Reference.

e) For your evaluation, the breakdown of the abovementioned all-inclusive amount is attached hereto as Annex 2;

f) I recognize that the payment of the abovementioned amounts due to me shall be based on my delivery of outputs within the timeframe specified in the TOR, which shall be subject to UNDP's review, acceptance and payment certification procedures;

g) This offer shall remain valid for a total period of 90days after the submission deadline;

h) I confirm that I have no first degree relative (mother, father, son, daughter, spouse/partner, brother or sister) currently employed with any UN agency or office *[disclose the name of the relative, the UN office employing the relative, and the relationship if, any such relationship exists];*

i) If I am selected for this assignment, I shall *[pls. check the appropriate box]:*

☐ Sign an Individual Contract with UNDP;

☐ Request my employer *[state name of company/organization/institution]* to sign with UNDP a Reimbursable Loan Agreement (RLA), for and on my behalf. The contact person and details of my employer for this purpose are as follows:

_____

j) I hereby confirm that *[check all that applies]*:

☐ At the time of this submission, I have no active Individual Contract or any form of engagement with any Business Unit of UNDP;

☐ I am currently engaged with UNDP and/or other entities for the following work :

Assignment	Contract Type	UNDP Business Unit / Name of Institution/Company	Contract Duration	Contract Amount

☐ I am also anticipating conclusion of the following work from UNDP and/or other entities for which I have submitted a proposal :

Assignment	Contract Type	Name of Institution/ Company	Contract Duration	Contract Amount

k) I fully understand and recognize that UNDP is not bound to accept this proposal, and I also understand and accept that I shall bear all costs associated with its preparation and submission and that UNDP will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the selection process.

l) ***If you are a former staff member of the United Nations recently separated, pls. add this section to your letter:*** I hereby confirm that I have complied with the minimum break in service required before I can be eligible for an Individual Contract.

m) I also fully understand that, if I am engaged as an Individual Contractor, I have no expectations nor entitlements whatsoever to be re-instated or re-employed as a staff member.

Full Name and Signature: Date Signed :

Annexes *[pls. check all that applies]*:

- ☐ CV or Duly signed P11 Form
- ☐ Breakdown of Costs Supporting the Final All-Inclusive Price as per Template
- ☐ Brief Description of Approach to Work (if required by the TOR)

BREAKDOWN OF COSTS
SUPPORTING THE ALL-INCLUSIVE FINANCIAL PROPOSAL

A. **Breakdown of Cost by Components:**

Cost Components	Unit Cost	Quantity	Total Rate for the Contract Duration
I. Personnel Costs			
Others (pls. specify)			

B. **Breakdown of Cost by Deliverables***

Deliverables *[list them as referred to in the TOR]*	**Percentage of Total Price (Weight for payment)**	**Amount**
Deliverable 1 - Submission and approval of the inception Report.	10%	
Deliverable 2 - Submission and approval of the draft MTR Report.	30%	
Deliverable 3 - Finalization and approval of the MTR Report	60%	
Total	100%	USD ……

**Basis for payment tranches*

Annex II - Terms of Reference (ToR)

RC 34296

INTRODUCTION

The world is currently facing the COVID-19 pandemic wich affected people everywhere and brought a halt to global and local economic activity and transport systems, as well as unprecedented disruptions to daily life that undercut the societal fabric of opportunities for human interaction[1]. Nonetheless, In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation. These terms of reference (TOR) sets out the expectations for a Terminal Evaluation (TE) of the ***BRA/10/G31 - Sugarcane Renewable Electricity – SUCRE (PIMS 3515).***

In order to ensure the well-being and safety of UNDP's staff and contractors, as well as to ensure no harm is done to partners, communities and interlocutors, the implementation of this TE shall be undertaken virtually, according to item "Evaluation Approach and Method" of this TOR.

The essentials of the project to be evaluated are as follows:

PROJECT SUMMARY TABLE

Project Title:				
GEF Project ID:	2778		*at endorsement (Million US$)*	*at completion (Million US$)*
UNDP Project ID:	3515	GEF financing:	7,800,000.00	7,800,000.00
Country:	Brazil	IA/EA own:		
Region:	Latin America	Government:		
Focal Area:	Climate Change	Other:		
FA Objectives, (OP/SP):	GEF-4 | CC-SP3 | CC-SP4	Total co-financing:		
Executing Agency:	CNPEM	Total Project Cost:	7,800,000.00	7,800,000.00
Other Partners involved:		ProDoc Signature (date project began):		22/12/2O1O
		(Operational) Closing Date:	Proposed: 31/12/2019	Actual: 30/06/2020

OBJECTIVE AND SCOPE

The project was designed to create the conditions for sugar mills to increase the export of electricity generated by sugar cane trash and bagasse to the grid. This will be achieved by promoting the use of trash (sugarcane tops and leaves) as additional fuel to bagasse in the sugar mills, increasing the capacity of sugar mills to export electricity to the grid by approximately 70% from the baseline scenario. Expected outcomes are:

[1] Guidance Note: Good practices during COVID-19. OECD/DAC and IEO/UNDP, April 2020.

Outcome 1: Technology for sugarcane trash collection and conversion to exported electricity at sugarcane mills is commercially launched.

Outcome 2: Economic and financial viability of sugarcane trash collection and utilization for export of electricity from sugarcane mills is commercially demonstrated.

Outcome 3: Environmental integrity of the use of biomass for energy is assured.

Outcome 4: Dissemination, capacity building, replication strategy across the sugar cane sector is under implementation.

Outcome 5: Institutional, legal, regulatory framework is in place to promote the sustainable use of biomass for electricity generation and sales to the grid.

Outcome 6: Project monitoring, learning, adaptive feedback and evaluation

The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects.

The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

EVALUATION APPROACH AND METHOD

The evaluator is expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact,** as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects. A set of questions covering each of these criteria have been drafted and are included with this TOR (*Annex C*) The evaluator is expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report.

The evaluation must provide evidence-based information that is credible, reliable and useful. The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region and key stakeholders.

The evaluator is expected to conduct a virtual evaluation comprised of evaluation desk reviews and stakeholders' remote interviews. Interviews will be held with the organizations and individuals at a minimum according to Annex H.

Virtual evaluations come with numerous challenges such as limiting the evaluation scope and access to stakeholders and communities. Impacts and limitations of the virtual evaluation due to COVID-19 must be addressed in the inception report and clearly detailed in the final evaluation report.

The evaluator will review all relevant sources of information, such as the project document, project reports – including Annual APR/PIR, project budget revisions, midterm review, progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, and any other materials that the evaluator considers useful for this evidence-based assessment. A list of documents that the project team will provide to the evaluator for review is included in Annex B of this Terms of Reference.

EVALUATION CRITERIA & RATINGS

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework (see Annex A), which provides performance and impact indicators for project implementation along with their corresponding means of verification. The evaluation will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact.** Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary. The obligatory rating scales are included in Annex D.

Evaluation Ratings:			
1. Monitoring and Evaluation	***rating***	**2. IA& EA Execution**	***rating***
M&E design at entry		Quality of UNDP Implementation	
M&E Plan Implementation		Quality of Execution - Executing Agency	
Overall quality of M&E		Overall quality of Implementation / Execution	
3. Assessment of Outcomes	**rating**	**4. Sustainability**	**rating**
Relevance		Financial resources:	
Effectiveness		Socio-political:	
Efficiency		Institutional framework and governance:	
Overall Project Outcome Rating		Environmental :	
		Overall likelihood of sustainability:	

PROJECT FINANCE / COFINANCE

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Country Office (CO) and Project Team to obtain financial data in order to complete the co-financing table below, which will be included in the terminal evaluation report.

Co-financing (type/source)	UNDP own financing (mill. US$)		Government (mill. US$)		Partner Agency (mill. US$)		Total (mill. US$)	
	Planned	Actual	Planned	Actual	Planned	Actual	Actual	Actual
Grants								
Loans/Concessions								
• In-kind support								
• Other								
Totals								

MAINSTREAMING

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will assess the extent to which the project was successfully mainstreamed with other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and gender.

IMPACT

The evaluators will assess the extent to which the project is achieving impacts or progressing towards the achievement of impacts by measuring the project's indicators according to its tracking tools which assesses on GHG emissions mitigated, lifetime energy production and installed RE capacity. Additional impacts related to government capacity, legal and regulatory frameworks, amongst others, must also be assessed. All the impacts and progress must be backed up by evidence.

CONCLUSIONS, RECOMMENDATIONS & LESSONS

The evaluation report must include a chapter providing a set of **conclusions**, **recommendations** and **lessons**.

IMPLEMENTATION ARRANGEMENTS

The principal responsibility for managing this evaluation resides with the UNDP CO in Brazil that will contract the evaluator.

The Project Team will be responsible for liaising with the Evaluator to share the documents according to Annex B, as well as set up stakeholder interviews, coordinate with the Government, etc.

There will be no field mission to project site as afore mentioned, due to COVID-19 pandemic.

EVALUATION TIMEFRAME

The total duration of the evaluation will be 40 working days according to the following plan:

Activity	Timing
Preparation	*4* days
Inception Report	*5 days*
Virtual Evaluation (Desk Reviews and Interviews)	*6* days
Draft Evaluation Report	*10* days
Final Report	*5* days
Summary of Recommendations	*10 days*

EVALUATION DELIVERABLES

The evaluation team is expected to deliver the following:

Deliverable	Content	Timing	Responsibilities
Inception Report	Evaluator provides clarifications on timing and method	No later than 2 weeks before the virtual evaluation.	Evaluator submits to UNDP CO
Presentation	Initial Findings	End of virtual evaluation.	To project management, UNDP CO
Draft Final Report	Full report, (per annexed template) with annexes	Within 3 weeks of the virtual evaluation.	Sent to CO, reviewed by RTA, PCU, GEF OFPs
Final Report*	Revised report	Within 1 week of receiving UNDP comments on draft	Sent to CO for uploading to UNDP ERC.

*When submitting the final evaluation report, the evaluator is required also to provide an 'audit trail', detailing how all received comments have (and have not) been addressed in the final evaluation report.

TEAM COMPOSITION

The evaluation team will be composed of 1 *international evaluator.* The consultants shall have prior experience in evaluating similar projects. Experience with GEF financed projects is an advantage. The evaluator selected should not have participated in the project preparation and/or implementation and should not have conflict of interest with project related activities.

Mandatory Qualification:

- Minimum 5 years of relevant professional experience on climate change mitigation and/or renewable energy;
- Demonstrated understanding of issues related to gender sensitive evaluation and analysis;
- Proven experience leading UNDP-GEF Terminal Evaluations and/or Mid-Term Reviews;
- Proven knowledge of UNDP and GEF evaluation policies and procedures;
- Fluency in English with excellent writing skills.

Qualifying Qualifications

- Post-graduation on Environmental Sciences, Agriculture, Engineering, Rural Development or related field;
- Experience in working in Latin America;
- Fluency in Portuguese.

EVALUATOR ETHICS

Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the UNEG 'Ethical Guidelines for Evaluations'

PAYMENT MODALITIES AND SPECIFICATIONS

%	Milestone
10%	Upon the presentation of the Inception Report
40%	Following submission and approval of the 1ST draft terminal evaluation report
50%	Following submission and approval (UNDP-CO and UNDP RTA) of the final terminal evaluation report

Evaluation Procedure:
The final criteria for this selection process will be **technical capacity** and **price**.

Individual consultants will be evaluated based on a cumulative analysis taking into consideration the combination of the applicants' qualifications and financial proposal. The award of the contract shall be made to the individual **consultant whose offer has been evaluated and determined as:**
a. Classification of technical qualification (cv)
The maximum score in TECHNICAL QUALIFICATION is 100 points.

Analysis of the CV regarding compliance with the mandatory requirements specified in these Terms of Reference. Candidates who do not meet the minimum mandatory criteria described herein will be disqualified at this stage.

CV EVALUATION	SCORE	WEIGHT	SUBTOTAL
Relevant professional experience on climate change mitigation and/or renewable energy. Up to 6 years of experience: 1 point; More than 6 years and up to 7 years of experience 2 points; More than 7 years and up to 8 years of experience: 3 points; More than 8 years and up to 9 years of experience: 4 ponts; 10 years or more years of experience: 5 points.	1 to 5	6	30
Post-graduation on Environmental Sciences, Agriculture, Engineering, Rural Development or related field. Doctorate: 05 points; Master: 03 points; Specialization: 02 points.	2 to 5	4	20
Experience in working in Latin America. Less than 2 evaluations: 01 point). Less than 04 evaluations: 03 points; 04 evaluations or more: 05 points;	1 to 5	4	20
Fluency in Portuguese (Yes: 5; No: 0)	0 or 5	6	30
Maximum Score for Technical Classification			100

b. Classification of Financial Proposals (Price) – Final

Only the financial proposals (price) of candidates who attain **a final Score of 70 points or higher in the TECHNICAL CLASSIFICATION** will be taken into consideration.

The Final Score—FS—of the process will be reached by the sum of the **final Technical Score—TS multiplied by a factor of 0.70**, and the **Price Proposal score—PS—multiplied by a factor 0.30**, i.e.:

FS = TS x 0.70 + PS x 0.30
The **PS** score will be calculated according to the following formula:
PS = 100 x LPP / Ppe
Where:
PS = score of the price proposal
LPP = lowest price proposal
Ppe = price proposal under evaluation

The lowest price proposal will score one hundred (100).
The proposal achieving the highest final score will be selected.

ANNEX A: PROJECT LOGICAL FRAMEWORK

Project Strategy		Objectively Verifiable Indicators			
Goal: Increase the production of low greenhouse gas (GHG) electricity in the sugarcane industry, by using the trash, produced during the harvesting of green cane, as a renewable fuel to generate EE		The implementation of the SUCRE project will provide a practical experience of using trash from green harvesting, to increase the production of EE in sugar mills and distilleries, making available to all interested parties the technical and financial information required for spreading the demonstrated solution, making an important contribution to substantially increase the production of biomass EE in sugarcane mills and distilleries, and decreasing the emissions of GHG throughout the sugarcane industry.			
Strategy	**Indicators**	**Baseline**	**Target**	**Sources of Verification**	**Risks and Assumptions**
Objective of the Project: To create the conditions for sugar mills to increase the export of electricity generated by sugar cane trash and bagasse to the grid.	Trash system implemented and operating	No mills or distilleries are using the trash produced by the green harvesting	Trash system successfully demonstrated in one mill by end of year 3 Trash system successfully operating in 3 mills by end of project	PSC meetings held every 12 months - Progress reports issued every 6 months - Physical field inspection	***Risks***: - Difficulties in implementation of technical solutions ***Assumptions***: - Mills maintain interest in investment as expressed in commitment letters - Equipment and supplies are delivered on time
	Increase in exports of biomass based electricity to the grid	Electricity exports by mills limited to excess generation from sugarcane bagasse; no additional generation using sugarcane trash in place	70% increase in electricity exports from mills that implement the trash system 60,000 MWh/yr exported to the grid by mill 1 at end of yr 3 180,000 MWh/yr exported to the grid by mills 1, 2, and 3 at end of project	- Progress reports issued every 6 months - Sugar mill and electricity utility data	***Risks***: - Electricity output based on sugarcane trash generation is not as high as projected ***Assumptions***: - Electricity market conditions encourage mills to increase sales to the grid.
	Economic feasibility of increased generation with trash is demonstrated	Electricity sales are a limited operation in sugarcane mills	Increased revenues from additional electricity generation demonstrated in 3 mills The share of revenues from electricity generation increases in proportion to sugar and ethanol in 3 mills	- Progress reports issued every 6 months - Sugar mill financial data	***Risks***: - Costs of increased generation outweigh additional income stream - Fluctuations in electricity pricing affect the economic viability of increased generation ***Assumptions***: - Actual costs of increased generation are within the expected theoretical costs - PPAs are signed for electricity sales at an appropriate price - Electricity market conditions encourage mills to increase sales to the grid.

	Trash system replicated across the sugar sector	No mills or distilleries are using the trash produced by the green harvesting	Investment leveraged for installation of trash system in at least one additional mill by end of project Trash system feasibility studies for 7 other mills	- Progress reports issued every 6 months - Written commitment of investment by additional mist - Feasibility studies	***Risks***: - Demonstration in 3 initial mills insufficient to trigger sectorwide replication ***Assumptions***: - Sugarcane sector remains healthy and is prepared to invest
	Environmental and legal framework in place for electricity generation with bagasse	Environmental and regulatory conditions for increased generation with sugarcane trash not fully defined	Clear, streamlined environmental guidelines and procedures for generation with sugarcane trash Well defined regulatory framework for generation with sugarcane trash	- Environmental regulations - Electricity sector regulations - Project progress report	***Risks***: - Delays in clarification of environmental and electricity policies - Discrepancies between regulator entities and sugarcane sector ***Assumptions***: - Government support for the project - Environmental and electric market adjustments required are suitable for the environment and electricity regulators
	Information disseminated on project results and the benefits of additional generation with sugarcane trash	Limited information available on potential benefits of sugarcane trash use for electricity generation	Clear guidelines, procedures, and demonstrated benefits of generation with sugarcane trash are published and widely disseminated across the sugarcane sector in Brazil and internationally.	- Progress reports issued every 6 months - Published project documentation	***Assumptions***: - Project generates positive results that encourage sector wide adoption of technology.
Outcome 1: Technology for sugarcane trash collection and conversion for electricity generation has been made operational for commercial use.	Trash collection system design finalized and operational	- No methodology to define trash to be collected in place	- Methodology defined and being used	- Project progress reports - Practical test	***Risks***: - Not getting/agreeing on the proper methodology ***Assumptions***: - Team in place on schedule
		Conceptual design for trash collection system in place	Final design implemented and operational in mill #1	- Project progress reports - Physical inspection	***Risks***: - Timely availability of equipment
	Sale of additional 60,000 MWh/yr of electricity (from mill #1) after three years.	- No trash system installed	- Generation of electricity from trash at mill #1	- Project progress reports - Physical inspection	***Risks***: - Not having the trash system available for installation - Not getting the required permits - Not solving the legal and institutional issues ***Assumptions***: - Financial support available - Suppliers deliver on time - Team in place on schedule

Outcome 2: **The economic viability of sugarcane trash collection and utilization for electricity generation is demonstrated in commercial sugar mills.**	Economic feasibility is fully assessed prior to investment	Limited information on economic and financial viability in place, based on existing R&D	Full feasibility studies and business plans finalized for mills 1, 2, and 3	- Feasibility studies for 3 mills - Business plans for 3 mills	***Assumptions***: - Feasibility studies and business plans result in favorable economic valuation of projects
	Economic/financial performance of mills #1, #2, and #3 evaluated based on actual operating data and costs.	- No trash-electricity system available	- Economic feasibility demonstrated for use of trash to make exportable electricity at mills #1, #2, and #3.	- Study/report on trash-electricity economic analysis using collected actual data. - Project progress reports	***Risks***: - Costs of increased generation outweigh additional income stream - Fluctuations in electricity pricing affect the economic viability of increased generation ***Assumptions***: - Actual costs of increased generation are within the expected theoretical costs - PPAs are signed for electricity sales at an appropriate price - Electricity market conditions encourage mills to increase sales to the grid.
		- Electricity exports from mills limited to excess energy generated with sugarcane bagasse without trash	- 70 % increase in sale of electricity at mills #1, #2, and #3 due to inclusion of additional sugarcane trash	- Electricity sales contract - Physical verification - Mill operating reports - Project progress reports.	
Outcome 3: **The effects of sugar cane trash collection on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long-term sustainability.**	Guidelines for environmentally acceptable trash utilization completed and distributed	- No guidelines required as no trash system is in use	- Guidelines completed and in use	- Guidelines for trash utilization - Project progress reports - Seminars and newsletter	***Risks***: - Delays in clarification of environmental policies - Discrepancies between regulator entities and sugarcane sector ***Assumptions***: - Government support for the project - Environmental market adjustments required are suitable for the environment regulators
	Reduction of net GHG emissions associated with additional electricity generation verified based on actual operating data from mills #1, #2, and #3.	- No GHG reductions because no trash system in place	- Quantitative understanding of potential net GHG reductions from use of trash for electricity generation.	- Trash use GHG potential report - Project progress reports	***Risks***: - Not getting the proper information ***Assumptions***: - Trash system is implanted and operated successfully - Required information is available on time
			- Sector wide analysis of CDM potential for enhanced trash use.	- Project report - Project progress reports	***Risks***: - Not getting the proper information ***Assumptions***: - Trash system is implanted and operated successfully - Required information is available on time
	Sugarcane expansion clearly demonstrated as having minimal impact on deforestation	- Studies conducted to date do not link sugar sector to increased	- Specific assessment conducted to demonstrate the potential impacts on deforestation. - Mitigation strategy	- Project generated reports	***Risks***: - Assessment reveals more impact on deforestation than currently assumed ***Assumptions***: - Full information is available

	rates in Brazil	deforestation	developed and under implementation		to conduct assessment.
	Additional removal of trash for electricity generation demonstrated to have negligible detrimental impact on soil	Historical data suggests that additional trash removal does not impact soil quality	Project assessment conducted to further assess impact of trash removal on soil quality	- Project generated reports	***Risks***: - Assessment reveals more impact on soil quality than currently assumed ***Assumptions***: - Full information is available to conduct assessment.
Outcome 4: **Sugar cane trash is being utilized across the sugar cane sector with private investment taking benefit from lessons learned.**	Guidelines issued for general pre feasibility assessment in sugar mills	No existing guidelines or procedures in place	Clear, streamlined guidelines and procedures for assessing potential benefits of additional generation with sugarcane trash	- Project documentation	***Assumptions***: Knowledge generated through implementation in 3 mills is sufficient to generate guidelines
	Feasibility studies and basic engineering of 7 mills (beyond the first three) interested in installing the trash system completed.	- No pre-feasibility studies being made	- Guidelines for general pre-feasibility assessment of trash utilization - Feasibility studies for 7 mills (beyond the first three) completed	- Specific pre-feasibility studies - Project progress reports - Convinced investors	***Risks***: - Not getting the proper information ***Assumptions***: - Trash system is implanted and operated successfully - Required information is available on time
	Sale of additional 120,000 MWh/yr (from mills #2, and #3) after five years	- No trash system installed	- Generation of electricity from trash at mill #2 and #3	- Project progress reports - Physical inspection	***Risks***: - Not having the trash system available for installation - Not getting the required permits - Not solving the legal and institutional issues ***Assumptions***: - Financial support available - Suppliers deliver on time - Team in place on schedule
	Expressions of interest (contracted studies, letters of interest, participation at seminars, phone inquiries, etc.) from companies in trash-electricity, indicating market transformation.	- No trash system in place in additional mills - No investors interested	- Clear demonstration of interest by 7 additional mills in investing in additional electricity generation with trash	- Participant lists from seminars, emails and letters from interested investors, studies contracted, website visits - Convinced investors - Project progress reports	***Risks***: - Quality of information dissemination is inadequate to gain interest of stakeholders ***Assumptions***: - Information dissemination systems are effective
Outcome 5: **An adequate legal and regulatory framework is in place to promote the sustainable use of sugar cane trash for electricity generation and sales to the grid.**	Mutually beneficial regulations fostering increased electricity generation with sugarcane trash are implemented	- Current legislation favorable to IPP generation but does not consider technicalities of generation with bagasse	- Full knowledge of relevant legislation regulating the electricity sector in Brazil is obtained, including potential solutions to address remaining barriers for generation with trash	- Regulatory study report - Project progress reports	***Risks***: - Not getting the proper information ***Assumptions***: - Required information is available on time
			- Meetings conducted with relevant state	- Minutes of meetings - Project progress	***Risks***: - No access to government officials.

			entities to discuss new regulatory framework that addresses sugarcane industry trash-to-electricity issues and barriers - Mutually beneficial regulatory reforms agreed between regulating entities and the sugar sector	reports	***Assumptions***: - Meetings are held. - Electric market adjustments required are suitable for the environment and electricity regulators
Outcome 6: Project monitoring, learning, adaptive feedback and evaluation	Internal monitoring is applied and adaptive feedback mechanisms are implemented	Internal monitoring procedure described in project document	Internal monitoring procedures implemented with at least two project reports generated per year	- Project progress reports	***Risks*** - Lessons learnt during project implementation require major strategy revision ***Assumptions***: - Assumptions made during the project design process are valid, allowing for a project implementation that is aligned to the conditions presented in the project document **Note: Any major revisions to project outcomes and/or project objective will be consulted with the GEF Secretariat**
		Project document reflects current understanding of best project strategy	Project implementation strategy is strengthened by continuous integration of lessons learnt during implementation	- Project reports and amendment compilation	
	High quality external evaluations are conducted	No evaluations conducted	One Mid Term evaluation and One Final Evaluation conducted	Evaluation reports	***N/A***

ANNEX B: LIST OF DOCUMENTS TO BE REVIEWED BY THE EVALUATORS

1. AF Concept and/or Proposal, Project Document, Substantive Revisions, and Log Frame Analysis (LFA)
2. Project Implementation Plan
3. Implementing/Executing partner arrangements
4. List and contact details for project staff, key project stakeholders, including Project Boards, and other partners to be consulted
5. Original Project Document (PRODOC)
6. Substantive Revisions
7. Project sites, highlighting suggested visits
8. Mid Term Review (MTR) Report
9. Project Implementation Review (PIR)
10. Project budget and financial data
11. Project Tracking Tool, at the baseline and at the mid-term
12. UNDP Development Assistance Framework (UNDAF)
13. UNDP Country Programme Document (CPD)
14. UNDP Country Programme Action Plan (CPAP)Project Implementation Review (PIR)
15. Cooperation agreements signed between UNDP and donors
16. Project Technical Reports
17. Annual work plans including budgets
18. Quarterly/six monthly Progress Reports (QPRs) and quarterly Financial Reports (FRs)
19. Project board meetings/Project board meeting minutes.
20. Project Level Evaluation Guidance of UNDP-Supported, GEF Financed Projects.

ANNEX C: EVALUATION QUESTIONS

This is a generic list, to be further detailed with more specific questions by CO and UNDP GEF Technical Adviser based on the particulars of the project.

Evaluative Criteria Questions	Indicators	Sources	Methodology
Relevance: How does the project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels?			
•	•	•	•
•	•	•	•
•	•	•	•
Effectiveness: To what extent have the expected outcomes and objectives of the project been achieved?			
•	•	•	•
•	•	•	•
•		•	•
Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards?			
•	•	•	•
•	•	•	•
•	•	•	•
Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?			
•	•	•	•
•	•	•	•
•	•	•	•
Impact: Are there indications that the project has contributed to, or enabled progress toward, reduced environmental stress and/or improved ecological status?			
•	•	•	•
•	•	•	•

ANNEX D: RATING SCALES

Ratings for Outcomes, Effectiveness, Efficiency, M&E, I&E Execution	***Sustainability ratings:***	***Relevance ratings***
6: Highly Satisfactory (HS): no shortcomings 5: Satisfactory (S): minor shortcomings 4: Moderately Satisfactory (MS) 3. Moderately Unsatisfactory (MU): significant shortcomings 2. Unsatisfactory (U): major problems 1. Highly Unsatisfactory (HU): severe problems	4. Likely (L): negligible risks to sustainability 3. Moderately Likely (ML):moderate risks 2. Moderately Unlikely (MU): significant risks 1. Unlikely (U): severe risks	2. Relevant (R) 1.. Not relevant (NR) ***Impact Ratings:*** 3. Significant (S) 2. Minimal (M) 1. Negligible (N)
Additional ratings where relevant: Not Applicable (N/A) Unable to Assess (U/A		

ANNEX E: EVALUATION CONSULTANT CODE OF CONDUCT AND AGREEMENT FORM

Evaluators:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation Consultant Agreement Form[2]

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: _____

Name of Consultancy Organization (where relevant)**:** _____

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at *place* on *date*

Signature: _____

[2]www.unevaluation.org/unegcodeofconduct

ANNEX F: EVALUATION REPORT OUTLINE[3]

i. Opening page:
- Title of UNDP supported GEF financed project
- UNDP and GEF project ID#s.
- Evaluation time frame and date of evaluation report
- Region and countries included in the project
- GEF Operational Program/Strategic Program
- Implementing Partner and other project partners
- Evaluation team members
- Acknowledgements

ii. Executive Summary
- Project Summary Table
- Project Description (brief)
- Evaluation Rating Table
- Summary of conclusions, recommendations and lessons

iii. Acronyms and Abbreviations
(See: UNDP Editorial Manual[4])

1. Introduction
- Purpose of the evaluation
- Scope & Methodology
- Structure of the evaluation report

2. Project description and development context
- Project start and duration
- Problems that the project sought to address
- Immediate and development objectives of the project
- Baseline Indicators established
- Main stakeholders
- Expected Results

3. Findings
(In addition to a descriptive assessment, all criteria marked with (*) must be rated[5])

3.1 Project Design / Formulation
- Analysis of LFA/Results Framework (Project logic /strategy; Indicators)
- Assumptions and Risks

[3] The Report length should not exceed *40* pages in total (not including annexes).

[4] UNDP Style Manual, Office of Communications, Partnerships Bureau, updated November 2008

[5] Using a six-point rating scale: 6: Highly Satisfactory, 5: Satisfactory, 4: Marginally Satisfactory, 3: Marginally Unsatisfactory, 2: Unsatisfactory and 1: Highly Unsatisfactory, see section 3.5, page 37 for ratings explanations.

- Lessons from other relevant projects (e.g., same focal area) incorporated into project design
- Planned stakeholder participation
- Replication approach
- UNDP comparative advantage
- Linkages between project and other interventions within the sector
- Management arrangements

3.2 Project Implementation

- Adaptive management (changes to the project design and project outputs during implementation)
- Partnership arrangements (with relevant stakeholders involved in the country/region)
- Feedback from M&E activities used for adaptive management
- Project Finance:
- Monitoring and evaluation: design at entry and implementation (*)
- UNDP and Implementing Partner implementation / execution (*) coordination, and operational issues

3.3 Project Results

- Overall results (attainment of objectives) (*)
- Relevance(*)
- Effectiveness & Efficiency (*)
- Country ownership
- Mainstreaming
- Sustainability (*)
- Impact

4. Conclusions, Recommendations & Lessons

- Corrective actions for the design, implementation, monitoring and evaluation of the project
- Actions to follow up or reinforce initial benefits from the project
- Proposals for future directions underlining main objectives
- Best and worst practices in addressing issues relating to relevance, performance and success

5. Annexes

- ToR
- Itinerary
- List of persons interviewed
- Summary of field visits
- List of documents reviewed
- Evaluation Question Matrix
- Questionnaire used and summary of results
- Evaluation Consultant Agreement Form

ANNEX G: EVALUATION REPORT CLEARANCE FORM

(to be completed by CO and UNDP GEF Technical Adviser based in the region and included in the final document)

Evaluation Report Reviewed and Cleared by

UNDP Country Office
Name: _____
Signature: _____ Date: _____

UNDP GEF RTA
Name: _____
Signature: _____ Date: _____

ANNEX H: PROJECT SITES AND ORGANIZATIONS FOR INTERVIEWS

Institution	City - State
UNICA	São Paulo - SP
MCTIC	Brasília - DF
	Brasília - DF
	Brasília - DF
Raizen	Piracicaba - SP
Usina Quatá	Lençóis Paulista - SP
Usina da Pedra	Serrana - SP
Usina Alta Mogiana	São Joaquim da Barra - SP
Usina São Luiz de Ourinhos	Ourinhos - SP
Usina Santa Isabel	Novo Horizonte - SP
Cerradinho Bioenergia	Chapadao do Céu - GO
Caeté	São Miguel dos Campos - AL
Usina Ferrari	Porto Ferreira - SP

Annex III - Contract Model

UNITED NATIONS DEVELOPMENT PROGRAMME

Contract for the services of an Individual Contractor

No_____

This Contract is entered into on [insert date] between the United Nations Development Programme (hereinafter referred to as "UNDP") and _____ (hereinafter referred to as "the Individual Contractor") whose address is _____.

WHEREAS UNDP desires to engage the services of the Individual Contractor on the terms and conditions hereinafter set forth, and:

WHEREAS the Individual Contractor is ready and willing to accept this Contract with UNDP on the said terms and conditions,

NOW, THEREFORE, the Parties hereby agree as follows:

1. Nature of services

The Individual Contractor shall perform the services as described in the Terms of References which form an integral part of this Contract and are attached hereto as *Annex I* in the following Duty Station(s): _____.

2. Duration

This Individual Contract shall commence on [insert date], and shall expire upon satisfactory completion of the services described in the Terms of Reference mentioned above, but not later than [insert date], unless sooner terminated in accordance with the terms of this Contract. This Contract is subject to the General Conditions of Contract for Individual contractors which are available on UNDP website at www.undp.org/procurement and are attached hereto as *Annex II*.

3. Consideration

As full consideration for the services performed by the Individual Contractor under the terms of this Contract, including, unless otherwise specified, his/her travel to and from the Duty Station(s), any other travel required in the fulfillment of the Terms of Reference in Annex I, and living expenses in the Duty Station(s), UNDP shall pay the Individual Contractor a total of [currency] ––––––– in accordance with the table set forth below[6]. Payments shall be made following certification by UNDP that the services related to each Deliverable, as described below, have been satisfactorily performed and the Deliverables have been achieved by or before the due dates specified below, if any.

DELIVERABLE	DUE DATE	AMOUNT IN [CURRENCY]

[6] For payments which are not output-based lump sum, indicate the maximum number of working days/hours/units, any out of pocket expense (travel, per diem…) and the corresponding fee/cost in the Deliverable (s) table.

If unforeseen travel outside the Duty Station not required by the Terms of Reference is requested by UNDP, and upon prior written agreement, such travel shall be at UNDP's expense and the Individual Contractor shall receive a *per diem* not to exceed United Nations daily subsistence allowance rate in such other location(s).

Where two currencies are involved, the rate of exchange shall be the official rate applied by the United Nations on the day the UNDP instructs its bank to effect the payment(s).

4. Rights and Obligations of the Individual contractor

The rights and obligations of the Individual Contractor are strictly limited to the terms and conditions of this Contract, including its Annexes. Accordingly, the Individual Contractor shall not be entitled to any benefit, payment, subsidy, compensation or entitlement, except as expressly provided in this Contract. The Individual Contractor shall be solely liable for claims by third parties arising from the Individual Contractor's own acts or omissions in the course of performing this Contract, and under no circumstances shall UNDP be held liable for such claims by third parties.

5. Beneficiary

The Individual Contractor selects _____ as beneficiary of any amounts owed under this Contract in the event of death of the Individual Contractor while performing services hereunder. This includes the payment of any service-incurred liability insurance attributable to the performance of the services for UNDP.

Mailing address, email address and phone number of beneficiary:

_____
_____

Mailing address, email address and phone number of emergency contact (if different from beneficiary):

_____
_____

IN WITNESS WHEREOF, the Parties hereto have executed this Contract.

By signing below, I, the Individual Contractor, acknowledge and agree that I have read and accept the terms of this Contract, including the General Conditions of Contracts for Individual contractors available on UNDP website at www.undp.org/procurement **and attached hereto in Annex II which form an integral part of this Contract, and that I have read and understood, and agree to abide by the standards of conduct set forth in the Secretary-General's bulletins ST/SGB/2003/13 of 9 October 2003, entitled "Special Measures for Protection from Sexual Exploitation and Sexual Abuse" and ST/SGB/2002/9 of 18 June 2002, entitled "Regulations Governing the Status, Basic Rights and Duties of Officials other than Secretariat Officials, and Experts on Mission".**

□ The Individual Contractor has submitted a Statement of Good Health and confirmation of immunization.

AUTHORIZING OFFICER: **United Nations Development Programme**	**INDIVIDUAL CONTRACTOR:**
Name; _____	**Name; _____**
Signature; _____	**Signature; _____**
Date; _____	**Date; _____**

GENERAL CONDITIONS OF CONTRACT FOR THE SERVICES OF INDIVIDUAL CONTRACTORS

1 February 2012

1. **LEGAL STATUS:** The Individual contractor shall have the legal status of an independent contractor vis-à-vis the United Nations Development Programme (UNDP), and shall not be regarded, for any purposes, as being either a "staff member" of UNDP, under the UN Staff Regulations and Rules, or an "official" of UNDP, for purposes of the Convention on the Privileges and Immunities of the United Nations, adopted by the General Assembly of the United Nations on 13 February 1946. Accordingly, nothing within or relating to the Contract shall establish the relationship of employer and employee, or of principal and agent, between UNDP and the Individual contractor. The officials, representatives, employees or subcontractors of UNDP and of the Individual contractor, if any, shall not be considered in any respect as being the employees or agents of the other, and UNDP and the Individual contractor shall be solely responsible for all claims arising out of or relating to their engagement of such persons or entities.

2. **STANDARDS OF CONDUCT: In General**: The Individual contractor shall neither seek nor accept instructions from any authority external to UNDP in connection with the performance of his or her obligations under the Contract. Should any authority external to UNDP seek to impose any instructions regarding the Individual contractor's performance under the Contract, the Individual contractor shall promptly notify UNDP and shall provide all reasonable assistance required by UNDP. The Individual contractor shall not take any action in respect of his or her performance of the Contract or otherwise related to his or her obligations under the Contract that may adversely affect the interests of UNDP. The Individual contractor shall perform his or her obligations under the Contract with the fullest regard to the interests of UNDP. The Individual contractor warrants that she or he has not and shall not offer any direct or indirect benefit arising from or related to the performance of the Contract or the award thereof to any representative, official, employee or other agent of UNDP. The Individual contractor shall comply with all laws, ordinances, rules and regulations bearing upon the performance of his or her obligations under the Contract. In the performance of the Contract the Individual contractor shall comply with the standards of conduct set in the Secretary General's Bulletin ST/SGB/2002/9 of 18 June 2002, entitled "Regulations Governing the Status, Basic Rights and Duties of Officials other than Secretariat Officials, and Expert on Mission". The Individual contractor must comply with all security directives issued by UNDP.

Prohibition of Sexual Exploitation and Abuse: In the performance of the Contract, the Individual contractor shall comply with the standards of conduct set forth in the Secretary-General's bulletin ST/SGB/2003/13 of 9 October 2003, concerning "Special measures for protection from sexual exploitation and sexual abuse". In particular, the Individual contractor shall not engage in any conduct that would constitute sexual exploitation or sexual abuse, as defined in that bulletin.

The Individual contractor acknowledges and agrees that any breach of any of the provisions hereof shall constitute a breach of an essential term of the Contract, and, in addition to any other legal rights or remedies available to any person, shall give rise to grounds for suspension or termination of the Contract. In addition, nothing herein shall limit the right of UNDP to refer any alleged breach of the foregoing standards of conduct or any other terms of the Contract to the relevant national authorities for appropriate legal action.

3. **TITLE RIGHTS, COPYRIGHTS, PATENTS AND OTHER PROPRIETARY RIGHTS:** Title to any equipment and supplies that may be furnished by UNDP to the Individual contractor for the performance of any obligations under the Contract shall rest with UNDP, and any such equipment and supplies shall be returned to UNDP at the conclusion of the Contract or when no longer needed by the Individual contractor. Such equipment and supplies, when returned to UNDP, shall be in the same condition as when delivered to the Individual contractor, subject to normal wear and tear, and the Individual contractor shall be liable to compensate UNDP for any damage or degradation of the equipment and supplies that is beyond normal wear and tear.

UNDP shall be entitled to all intellectual property and other proprietary rights, including, but not limited to, patents, copyrights and trademarks, with regard to products, processes, inventions, ideas, know-how or documents and other materials which the Individual contractor has developed for UNDP under the Contract and which bear a direct relation to, or are produced or prepared or collected in consequence of, or during the course of, the performance of the Contract, and the Individual contractor acknowledges and agrees that such products, documents and other materials constitute works made for hire for UNDP. However, to the extent that any such intellectual property or other proprietary rights consist of any intellectual property or other proprietary rights of the Individual contractor: (a) that pre-existed the performance by the Individual contractor of his or her obligations under the Contract, or (b) that the Individual contractor may develop or acquire, or may have developed or acquired, independently of the performance of his or her obligations under the Contract, UNDP does not and shall not claim any ownership interest thereto, and the Individual contractor grants to UNDP a perpetual license to use such intellectual property or other proprietary right solely for the purposes of and in accordance with the requirements of the Contract. At the request of UNDP, the Individual contractor shall take all necessary steps, execute all necessary documents and generally assist in securing such proprietary rights and transferring or licensing them to UNDP in compliance with the requirements of the applicable law and of the Contract. Subject to the foregoing provisions, all maps, drawings, photographs, mosaics, plans, reports, estimates, recommendations, documents and all other data compiled by or received by the Individual contractor under the Contract shall be the property of UNDP, shall be made available for use or inspection by UNDP at reasonable times and in reasonable places, shall be treated as confidential and shall be delivered only to UNDP authorized officials on completion of services under the Contract

4. **CONFIDENTIAL NATURE OF DOCUMENTS AND INFORMATION:** Information and data that are considered proprietary by either UNDP or the Individual contractor or that are delivered or disclosed by one of them ("Discloser") to the other ("Recipient") during the course of performance of the Contract, and that are designated as confidential ("Information"), shall be held in confidence and shall be handled as follows. The Recipient of such Information shall use the same care and discretion to avoid disclosure, publication or dissemination of the Discloser's Information as it uses with its own similar information that it does not wish to disclose, publish or disseminate, and the Recipient may otherwise use the Discloser's Information solely for the purpose for which it was disclosed. The Recipient may disclose confidential Information to any other party with the Discloser's prior written consent, as well as to the Recipient's officials, representatives, employees, subcontractors and agents who have a need to know such confidential Information solely for purposes of performing obligations under the Contract. Subject to and without any waiver of the privileges and immunities of UNDP, the Individual contractor may disclose Information to the extent required by law, *provided that* the Individual contractor will give UNDP sufficient prior notice of a request for the disclosure of Information in order to allow UNDP to have a reasonable opportunity to take protective measures or such other action as may be appropriate before any such disclosure is made. UNDP may disclose Information to the extent required pursuant to the Charter of the United Nations, resolutions or regulations of the General Assembly or its other governing bodies, or rules promulgated by the Secretary-General. The Recipient shall not be precluded from disclosing Information that is obtained by the Recipient from a third party without restriction, is disclosed by the Discloser to a third party without any obligation of confidentiality, is previously known by the Recipient, or at any time is developed by the Recipient completely independently of any disclosures hereunder. These obligations and restrictions of confidentiality shall be effective during the term of the Contract, including any extension thereof, and, unless otherwise provided in the Contract, shall remain effective following any termination of the Contract. Notwithstanding the foregoing, the Individual contractor acknowledges that UNDP may, in its sole discretion, disclose the purpose, type, scope, duration and value of the Contract, the name of the Individual contractor, and any relevant information related to the award of the Contract.

5. **TRAVEL, MEDICAL CLEARANCE AND SERVICE INCURRED DEATH, INJURY OR ILLNESS:** If the Individual contractor is required by UNDP to travel beyond commuting distance from the Individual contractor's usual place of residence, and upon prior written agreement, such travel shall be at the expense of UNDP. Such travel shall be at economy fare when by air.

UNDP may require the Individual contractor to submit a "statement of good health" from a recognized physician prior to commencement of services in any offices or premises of UNDP, or before engaging in any travel required by UNDP, or connected with the performance of the Contract. The Individual contractor shall provide such a statement as soon as practicable following such request, and prior to engaging in any such travel, and the Individual contractor warrants the accuracy of any such statement, including, but not limited to, confirmation that the Individual contractor has been fully informed regarding the requirements for inoculations for the country or countries to which travel may be authorized.

In the event of death, injury or illness of the Individual contractor which is attributable to the performance of services on behalf of UNDP under the terms of the Contract while the Individual contractor is traveling at UNDP expense or is 2 February 2012 performing any services under the Contract in any offices or premises of UNDP, the Individual contractor or the Individual contractor's dependents, as appropriate, shall be entitled to compensation equivalent to that provided under the UNDP insurance policy, available upon request.

6. **PROHIBITION ON ASSIGNMENT; MODIFICATIONS:** The Individual contractor may not assign, delegate, transfer, pledge or make any other disposition of the Contract, of any part thereof, or of any of the rights, claims or obligations under the Contract except with the prior written authorization of UNDP, and any attempt to do so shall be null and void. The terms or conditions of any supplemental undertakings, licenses or other forms of Contract concerning any goods or services to be provided under the Contract shall not be valid and enforceable against UNDP nor in any way shall constitute a contract by UNDP thereto, unless any such undertakings, licenses or other forms of contract are the subject of a valid written undertaking by UNDP. No modification or change in the Contract shall be valid and enforceable against UNDP unless provided by means of a valid written amendment to the Contract signed by the Individual contractor and an authorized official or appropriate contracting authority of UNDP.

7. **SUBCONTRACTORS:** In the event that the Individual contractor requires the services of subcontractors to perform any obligations under the Contract, the Individual contractor shall obtain the prior written approval of UNDP for any such subcontractors. UNDP may, in its sole discretion, reject any proposed s u b contractor or require such subcontractor's removal without having to give any justification therefore, and such rejection shall not entitle the Individual contractor to claim any delays in the performance, or to assert any excuses for the non-performance, of any of his or her obligations under the Contract. The Individual contractor shall be solely responsible for all services and obligations performed by his or her subcontractors. The terms of any subcontract shall be subject to, and shall be construed in a manner that is fully in accordance with, all of the terms and conditions of the Contract.

8. **USE OF NAME, EMBLEM OR OFFICIAL SEAL OF THE UNITED NATIONS**: The Individual contractor shall not advertise or otherwise make public for purposes of commercial advantage or goodwill that it has a contractual relationship with UNDP, nor shall the Individual contractor, in any manner whatsoever, use the name, emblem or official seal of UNDP, or any abbreviation of the name of UNDP, in connection with his or her business or otherwise without the written permission of UNDP.

9. **INDEMNIFICATION**: The Individual contractor shall indemnify, defend, and hold and save harmless UNDP, and its officials, agents and employees, from and against all suits, proceedings, claims, demands, losses and liability of any kind or nature, including, but not limited to, all litigation costs and expenses, attorney's fees, settlement payments and damages, based on, arising from, or relating to: (a) allegations or claims that the use by UNDP of any patented device, any copyrighted material or any other goods or services provided to UNDP for its use under the terms of the Contract, in whole or in part, separately or in combination, constitutes an infringement of any patent, copyright, trademark or other intellectual property right of any third party; or (b) any acts or omissions of the Individual contractor, or of any subcontractor or anyone directly or indirectly employed by them in the performance of the Contract, which give rise to legal liability to anyone not a party to the Contract, including, without limitation, claims and liability in the nature of a claim for workers' compensation.

10. **INSURANCE**: The Individual contractor shall pay UNDP promptly for all loss, destruction or damage to the property of UNDP caused by the Individual contractor, or of any subcontractor, or anyone directly or indirectly employed by them in the performance of the Contract. The Individual contractor shall be solely responsible for taking out and for maintaining adequate insurance required to meet any of his or her obligations under the Contract, as well as for arranging, at the Individual contractor's sole expense, such life, health and other forms of insurance as the Individual contractor may consider to be appropriate to cover the period during which the Individual contractor provides services under the Contract. The Individual contractor acknowledges and agrees that none of the insurance arrangements the Individual contractor shall, in any way, be construed to limit the Individual contractor's liability arising under or relating to the Contract.

11. **ENCUMBRANCES AND LIENS:** The Individual contractor shall not cause or permit any lien, attachment or other encumbrance by any person to be placed on file or to remain on file in any public office or on file with UNDP against any monies due to the Individual contractor or to become due for any work donor or against any goods supplied or materials furnished under the Contract, or by reason of any other claim or demand against the Individual contractor.

12. **FORCE MAJEURE; OTHER CHANGES IN CONDITIONS:** In the event of and as soon as possible after the occurrence of any cause constituting *force majeure*, the Individual contractor shall give notice and full particulars in writing to UNDP of such occurrence or cause if the Individual contractor is thereby rendered unable, wholly or in part, to perform his or her obligations and meet his or her responsibilities under the Contract. The Individual contractor shall also notify UNDP of any other changes in conditions or the occurrence of any event, which interferes or threatens to interfere with the performance of the Contract. Not more than fifteen (15) days following the provision of such notice of *force majeure* or other changes in conditions or occurrence, the Individual contractor shall also submit a statement to UNDP of estimated expenditures that will likely be incurred for the duration of the change in conditions or the event. On receipt of the notice or notices required hereunder, UNDP shall take such action as it considers, in its sole discretion, to be appropriate or necessary in the circumstances, including the granting to the Individual contractor of a reasonable extension of time in which to perform any obligations under the Contract or suspension thereof.

Force majeure as used herein means any unforeseeable and irresistible act of nature, any act of war (whether declared or not), invasion, revolution, insurrection, or any other acts of a similar nature or force, *provided that* such acts arise from causes beyond the control and without the fault or negligence of the Individual contractor. The Individual contractor acknowledges and agrees that, with respect to any obligations under the Contract that the Individual contractor must perform in or for any areas in which UNDP is engaged in, preparing to engage in, or disengaging from any peacekeeping, humanitarian or similar operations, any delay or failure to perform such obligations arising from or relating to harsh conditions within such areas or to any incidents of civil unrest occurring in such areas shall not, in and of itself, constitute *force majeure* under the Contract.

13. **TERMINATION**: Either party may terminate the Contract, in whole or in part, upon giving written notice to the other party. The period of notice shall be five (5) days in the case of contracts for a total period of less than two (2) months and fourteen (14) days in the case of contracts for a longer period. The initiation of conciliation or arbitral proceedings, as provided below, shall not be deemed to be a "cause" for or otherwise to be in itself a termination of the Contract. UNDP may, without prejudice to any other right or remedy available to it, terminate the Contract forthwith in the event that: (a) the Individual contractor is adjudged bankrupt, or is liquidated, or becomes insolvent, applies for moratorium or stay on any payment or repayment obligations, or applies to be declared insolvent; (b) the Individual contractor is granted a moratorium or a stay or is declared insolvent; (c) the Individual contractor makes an assignment for the benefit of one or more of his or her creditors; (d) a Receiver is appointed on account of the insolvency of the Individual contractor; (e) the Individual contractor offers a settlement in lieu of bankruptcy or receivership; or (f) UNDP reasonably determines that the Individual contractor has become subject to a materially adverse change in financial condition that threatens to endanger or otherwise substantially affect the ability of the Individual contractor to perform any of the obligations under the Contract.

In the event of any termination of the Contract, upon receipt of notice of termination by UNDP, the Individual contractor shall, except as may be directed by UNDP in the notice of termination or otherwise in writing: (a) take immediate steps to bring the performance of any obligations under the Contract to a close in a prompt and orderly manner, and in doing so, reduce expenses to a minimum; (b) refrain from undertaking any further or additional commitments under the Contract as of and following the date of receipt of such notice; (c) deliver all completed or partially completed plans, drawings, information and other property that, if the Contract had been completed, would be required to be furnished to UNDP thereunder; (d) complete performance of the services not

terminated; and (e) take any other action that may be necessary, or that UNDP may direct in writing, for the protection and preservation of any property, whether tangible or intangible, related to the Contract that is in the possession of the Individual contractor and in which UNDP has or may be reasonably expected to acquire an interest.

In the event of any termination of the Contract, UNDP shall only be liable to pay the Individual contractor compensation on a pro rata basis for no more than the actual amount of work performed to the satisfaction of UNDP in accordance with the requirements of the Contract. Additional costs incurred by UNDP as a result of termination of the Contract by the Individual contractor may be withheld from any amount otherwise due to the Individual contractor by UNDP.

14. **NON-EXCLUSIVITY**: UNDP shall have no obligation respecting, and no limitations on, its right to obtain goods of the same kind, quality and quantity, or to obtain any services of the kind described in the Contract, from any other source at any time.

15. **TAXATION:** Article II, section 7, of the Convention on the Privileges and Immunities of the United Nations provides, *inter alia*, that the United Nations, including its subsidiary organs, is exempt from all direct taxes, except charges for public utility services, and is exempt from customs restrictions, duties and charges of a similar nature in respect of articles imported or exported for its official use. In the event any governmental authority refuses to recognize the exemptions of the United Nations from such taxes, restrictions, duties or charges, the Individual contractor shall immediately consult with UNDP to determine a mutually acceptable procedure. UNDP shall have no liability for taxes, duties or other similar charges payable by the Individual contractor in respect of any amounts paid to the Individual contractor under this Contract, and the Individual contractor acknowledges that UNDP will not issue any statements of earnings to the Individual contractor in respect of any such payments.

16. **AUDITS AND INVESTIGATIONS**: Each invoice paid by UNDP shall be subject to a post-payment audit by auditors, whether internal or external, of UNDP or by other authorized and qualified agents of UNDP. The Individual contractor acknowledges and agrees that UNDP may conduct investigations relating to any aspect of the Contract or the award thereof, and the obligations performed thereunder.

The Individual contractor shall provide full and timely cooperation with any post-payment audits or investigations hereunder. Such cooperation shall include, but shall not be limited to, the Individual contractor's obligation to make available any relevant documentation and information for the purposes of a post-payment audit or an investigation at reasonable times and on reasonable conditions. The Individual contractor shall require his or her employees, subcontractors and agents, if any, including, but not limited to, the Individual contractor's attorneys, accountants or other advisers, to reasonably cooperate with any post-payment audits or investigations carried out by UNDP hereunder.

If the findings or circumstances of a post-payment audit or investigation so warrant, UNDP may, in its sole discretion, take any measures that may be appropriate or necessary, including, but not limited to, suspension of the Contract, with no liability whatsoever to UNDP.

The Individual contractor shall refund to UNDP any amounts shown by a post-payment audit or investigation to have been paid by UNDP other than in accordance with the terms and conditions of the Contract. Such amount may be deducted by UNDP from any payment due to the Individual contractor under the Contract.

The right of UNDP to conduct a post-payment audit or an investigation and the Individual contractor's obligation to comply with such shall not lapse upon expiration or prior termination of the Contract.

17. **SETTLEMENT OF DISPUTES**:

AMICABLE SETTLEMENT: UNDP and the Individual contractor shall use their best efforts to amicably settle any dispute, controversy or claim arising out of the Contract or the breach, termination or invalidity thereof. Where the parties wish to seek such an amicable settlement through conciliation, the conciliation shall take place in accordance with the Conciliation Rules then obtaining of the United Nations Commission on International Trade Law ("UNCITRAL"), or according to such other procedure as may be agreed between the parties in writing.

ARBITRATION: Any dispute, controversy or claim between the parties arising out of the Contract, or the breach, termination, or invalidity thereof, unless settled amicably, as provided above, shall be referred by either of the parties to arbitration in accordance with the UNCITRAL Arbitration Rules then obtaining. The decisions of the arbitral tribunal shall be based on general principles of international commercial law. For all evidentiary questions, the arbitral tribunal shall be guided by the Supplementary Rules Governing the Presentation and Reception of Evidence in International Commercial Arbitration of the International Bar Association, 28 May 1983 edition. The arbitral tribunal shall be empowered to order the return or destruction of goods or any property, whether tangible or intangible, or of any confidential information provided under the Contract, order the termination of the Contract, or order that any other protective measures be taken with respect to the goods, services or any other property, whether tangible or intangible, or of any confidential information provided under the Contract, as appropriate, all in accordance with the authority of the arbitral tribunal pursuant to Article 26 ("Interim Measures of Protection") and Article 32 ("Form and Effect of the Award") of the UNCITRAL Arbitration Rules. The arbitral tribunal shall have no authority to award

punitive damages. In addition, unless otherwise expressly provided in the Contract, the arbitral tribunal shall have no authority to award interest in excess of the London Inter-Bank Offered Rate ("LIBOR") then prevailing, and any such interest shall be simple interest only. The parties shall be bound by any arbitration award rendered as a result of such arbitration as the final adjudication of any such dispute, controversy or claim.

18. **LIMITATION ON ACTIONS**: Except with respect to any indemnification obligations in Article 9, above, or as are otherwise set forth in the Contract, any arbitral proceedings in accordance with Article 17, above, arising out of the Contract must be commenced within three (3) years after the cause of action has accrued.

The Parties further acknowledge and agree that, for these purposes, a cause of action shall accrue when the breach actually occurs, or, in the case of latent defects, when the injured Party knew or should have known all of the essential elements of the cause of action, or in the case of a breach of warranty, when tender of delivery is made, except that, if a warranty extends to future performance of the goods or any process or system and the discovery of the breach consequently must await the time when such goods or other process or system is ready to perform in accordance with the requirements of the Contract, the cause of action accrues when such time of future performance actually begins.

19. **PRIVILEGES AND IMMUNITIES**: Nothing in or relating to the Contract shall be deemed a waiver, express or implied, of any of the privileges and immunities of the United Nations, including its subsidiary organs.

TE PIMS 3515. SUCRE. Annex 2. Itinerary and list of persons interviewed.

Organization/ Mill	Name	Position	Date
LNBR	Manoel Regis Lima Verde Leal	National Project Director	07/07/07, 26/08/20 and 28/10/20
LNBR	Thayse Aparecida Dourado Hernandes	Project Coordinator	07/07/07, 26/08/20 and 28/10/20
LNBR	Eduardo Couto	LNBR Director	07/07/07 and 26/08/20
UNDP	Haroldo de Oliveira Machado Filho	Programme Officer	07/07/20 and 28/10/20
Usina Boa Vista (São Martinho)	René de Assis Sordi	Gerente Agrícola	27/7/20
Usina Santa Isabel	Ariane Garcia	Supervisora de Processos Industriais	28/07/20
UNICA	Zilmar de Souza	Gerente de Bioeletricidade	29/07/20
CGEE	Marcelo Poppe	Assessor	05/08/20
MRE - ABC	Alessandra Ambrósio	Coordenadora Geral	12/08/20
Cerradinho Bioenergia	Walter Di Mastrogirolamo	Gerente Industrial	19/08/20
Caeté	André Enders	Engenheiro Mecânico	20/08/20
UNDP	Lucia Cortina	RTA	26/08/20
Raizen	Bernardo Rocheta Caeiro Pegado Mendonça	New Business Development Senior Analyst	28/08/20
UNDP	Ludmilla Diniz	RTA	04/09/20
MCTI	Eduardo Soriano	Diretor do Departamento de Tecnologias Estruturantes da Secretaria de Empreendedorismo e Inovação	03/11/20
MCTI	Gustavo Ramos	Coordenador e Especialista em Políticas Públicas	03/11/20
MCTI	Rafael Menezes	Coordenador-Geral de Estratégias e Negócios da Secretaria de Empreendedorismo e Inovação	03/11/20

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Annex 1. Evaluation Matrix (preliminary)

Evaluative criteria	Questions	Answers	Sources
Project design: project logic and strategy, indicators, lessons learned, assumptions and risks and planned stakeholder engagement	*Was the project's ToC robust?*	Yes, the project design clearly identified the problem (unused potential for renewable energy generation of sugarcane trash), the technical, environmental (agronomic) and regulatory barriers to realize the potential	Project Document (2015) Midterm review Project inception workshop report Mill representatives Government representatives
	Were the assumptions and risks logical, and well-formulated?	Yes, the project assumptions and risk were well formulated, albeit assumptions and risks overlapped. The project assumed a continuing growth of the sugarcane energy market under current environmental rules and (mechanical harvest), and energy prices (assumption held). The project's main risk was the economic unfeasibility of trash use for co-generation.	Project Document (2015)
	Were there any relevant externalities addressed (i.e. effects of climate change, global economic crisis, etc.)?	Yes, the project design explicitly referred to environmental (GHG emissions, expansion of sugarcane fields, water use, pollution), social (employment), and well-based assumptions on the evaluation of energy products from sugar mills	Project Document (2015) Midterm review Project inception workshop report Mill representatives Government representatives
	Were the project's results clearly formulated, based on the project's assumptions, and feasible within the project's time frame?	Yes, the project results were clearly formulated, feasible and based on the assumptions	Project Document (2015) Midterm review Mill representatives Government representatives
	Were the framework's indicators SMART ?	Yes, the framework indicators were SMART	Project Document (2015) Midterm review

Evaluative criteria	Questions	Answers	Sources
Project design: project logic and strategy, indicators, lessons learned, assumptions and risks and planned stakeholder engagement	*Were lessons from other projects incorporated in the project design?*	Yes, the project design based on results of Biomass Power Generation project (BRA/96/G31, GEF 1), and models and research conducted by the CTC and CTBE	Project Document (2015) Midterm review Project inception workshop report Sugarcane industry experts
	Were the perspectives of those who would be affected by project decisions, those who could affect the outcomes, and those who could contribute information or other resources to the process, taken into account during project design processes?	Yes, main stakeholders of the project were mill managers and technical staff who participated in the project implementation and project board meetings.	Project Document (2015) Midterm review MTR management response Project inception workshop report Minutes of project board meetings Project stakeholders
	Were the partnership arrangements properly identified and roles and responsibilities negotiated prior to project approval?	Yes, the partnership arrangements were properly identified, and roles negotiated and assigned prior to project approval	Project Document (2015) Midterm review Project inception workshop report Sugarcane industry experts
	Was the project designed to address country priorities and be country-driven?	Yes, the project was inspired by national initiatives (Proalcool), designed by national experts and conceived and implemented within Federal research institutions with active collaboration from the national industry	Project Identification Form (2007) Project Document (2015) Midterm review Project inception workshop report Project Implementation Reports Sugarcane industry experts

Evaluative criteria	Questions	Answers	Sources
Project implementation: adaptive management, actual stakeholder participation and partnership arrangements, Project finance and co-finance; M&E design and implementation	*What significant changes did the project undergo as a result of recommendations from the MTR, or other review procedures?* *Were the project changes articulated in writing and then considered and approved by the Project Board?*	The project design undertook an exhaustive review in 2013 that achieved a substantive revision enabling the implementation of the project. No major changes other than a non-cost extension (December 2020) were proposed by the MTR	Evaluation of Implementation Arrangements and Substantive Revision Proposal (2013) Project document (2015) Midterm review MTR management response
	Did the project develop and leverage partnerships with appropriate stakeholders? *Did stakeholder involvement contribute to the project objectives?* *How did actual stakeholder interaction compare to what was planned?* *Did local and national government stakeholders support the objectives of the project?*	Yes, the project developed strong partnerships with sugar mills who strongly supported the project beyond expectations at designs (10 mills at design stage, 12 actually participating in the project. Their involvement was critical to project success National government strongly supportive of project (to be completed)	Technical reports Midterm review MTR management response Minutes of project board meetings Mill representatives Government representatives

Evaluative criteria	Questions	Answers	Sources
Project implementation: adaptive management, actual stakeholder participation and partnership arrangements, Project finance and co-finance; M&E design and implementation	*Did the financial system enable the timely flow of funds and for the payment of satisfactory project deliverables?* *Were there variances between planned and actual expenditures?*	Financial management of the project according to national and UNDP rules, with small variation between AWPs and actual expending	Combined Delivery Reports Annual Working Plans
	Were the project's outcomes supported by the extent of co-financing? *Was there sufficient clarity in the reported co-financing to substantiate it?*	The financial commitment of the mills for the field experiments was crucial for the project implementation Project partners (mills) have made investments in the Dry-Cleaning Systems and auxiliary equipment on trash collection by bales is estimated in US$ 120 million (committed at project design: US$ 55,800,000)	Project technical reports Project implementation reports Project stakeholders
	Was the M&E plan able to monitor results and track progress toward achieving objectives? Was data on specified indicators, relevant GEF/LDCF/SCCF Tracking Tools/Core Indicators gathered in a systematic manner? *Did the M&E plan include a baseline, data analysis, and evaluation studies at specific times to assess results?* *Was the M&E budget in the project document sufficient?*	Yes, the M&E system was able to track an impressive number of variables, all conducted to the highest scientific standards. Monitoring of data relevant to sugarcane trash use and environmental and electricity generation to continue in the future, as its institutionalized within CTBE/ LNBR Monitoring data public in user-friendly form for project stakeholders Yes, data on GHG emissions, relevant to the GEF tracking tool were collected Yes, monitoring and evaluation operations conducted as expected within project budget	Project technical reports Project implementation reports Project webpage Project stakeholders

Evaluative criteria	Questions	Answers	Sources
Project implementation: adaptive management, actual stakeholder participation and partnership arrangements, Project finance and co-finance; M&E design and implementation	*Did the UNDP delivered effectively on activities related to project identification, concept preparation, appraisal, preparation of detailed proposal, approval and start-up, oversight, supervision, completion and evaluation?*	Yes, UNDP's role was decisive in identifying and appraising the project and provided support through its "latent" stage and during actual implementation, providing for supervision and implementation of evaluation activities. UNDP's supported activities needed to implement innovative activities such as this project that cannot be covered under regular government or private sector budgets	Project technical reports Project implementation reports Government representatives
	Did the Implementing Partner effectively managed and administered the project's day-to-day activities under the overall oversight and supervision of UND?	Yes, undoubtedly. The project implementing partner effectively managed project implementation.	Project technical reports Project implementation reports UNDP representatives Project team Mills representatives Government representatives
Cross-cutting issues: Gender, poverty and environment nexus, climate change mitigation social and environmental standards (safeguards)	*Were gender issues (gender equality and women's empowerment) integrated in the project's strategy?*	No, the project was "gender blind", but it produced an assessment of differentiated employment impacts on men and women of energy generation from biomass. While technical and management positions in the sugar industry appear to be dominated by men, this is not due to any explicit barrier, but rather with historical inertia.	Project technical reports Project implementation reports UNDP representatives Project team Mills representatives
	How did the project aim to capture broader development impacts?	The project supported national and UNDP targets on climate change mitigation and equality in generation of quality employment, in line with outcome 1 and 2 of the 2017-2021 UNDAF Amount of electricity exported to the grid avoids emission of more than 500,000 metric tons of CO2 equivalent per year. Biomass-based electricity enables creation of 1400 additional jobs than with fossil fuels	UNDAF 2017-2021 Project technical reports and PIRs Project team Mills representatives

Evaluative criteria	Questions	Answers	Sources
Relevance	*How does the project relate to the main objectives of the GEF Focal area, and to the environment and development priorities a the local, regional and national level?*	The project supports GEF's and national mitigation targets, by helping to reduce GHG emissions. The project also addresses environmental concerns related to sugarcane cultivation	GEF 4 strategy Project document (2015) Project technical reports and PIRs Project team
Effectiveness	*Did the project contribute to the implementation of effective trash collection and processing systems?*	Systems of collection and removal of impurities ensuring adequate combustion of trash in boilers, developed with project support in operation in four mills	Project technical reports and PIRs Project team Mills representatives
	Did the project enabled increase in exports of biomass-based electricity to the grid?	4 partner mills selling on average 1 TWh of electricity to the grid (over the 0.2 TWh target. Project promoted adjustments in the regulatory framework to promote the export of biomass electricity. Yet, uncertainties and problems with non-compliance of the contracts remain	Project technical reports and PIRs Project team Mills representatives
	Did the project demonstrated economic feasibility of trash collection and use as fuel for co-generation?	The project developed models that showed that electricity generation using sugarcane trash generates additional revenue. However, this seem to depend on a combination of climatic conditions (that in turn determine appropriate amount of trash that can be removed), technical issues (corrosion, transportation etc.), price of alternative fuels, tax environment and electricity prices.	Project technical reports and PIRs Project team Mills representatives
	Did the project enabled replication of solutions of trash as fuel?	Yes, as demonstrated by involvement of a second batch of mills. However, actual use of trash depending on a combination of factors (see above) Potential for replication in other countries	Project technical reports and PIRs Project team Mills representatives
	Did the project produce environmental guidelines and procedures?	Yes. The project developed tools to calculate environmental impacts of trash including avoided GHG emissions	Project technical reports and PIRs Project team Mills representatives
	Did the project demonstrated benefits of generation with sugarcane trash are published and widely disseminated across the sugarcane sector in Brazil and internationally?	Yes, the project-developed systems, models and guidelines are disseminated during workshops, in peer-reviewed papers, online tools, and the COP 25	Project technical reports and PIRs Project team Mills representatives

Evaluative criteria	Questions	Answers	Sources
Impact	*Are there indications that the project has contributed to, or enabled progress toward reduced environmental stress and/or improved ecological status?*	Yes, over the reduction of GHG emissions and potential employment benefits, the project showed that 96% of the most recent expansion occurred within the sugarcane Agroecological Zoning did not contributed to deforestation, and that there are still more than 20 million hectares available for sugarcane expansion without significant environmental impacts.	Project technical reports and PIRs Project team Mills representatives
Sustainability	*To what extent are there financial, institutional, socio-political, and/or environmental risks to sustaining long-term project results?*	Financial sustainability of project solutions will depend on prices and regulatory environments, over which the project and/ or the mill have little control. Regulatory changes need yet to be discussed at the appropriate levels Sugar mills and industry representatives definitely interested in proposed solutions, but adoption varies across regions, and specific mill conditions Climate change or environmental degradation unlikely to affect sugarcane industry in the midterm	Project technical reports and PIRs Project team Mills representatives

Annex 3. Evaluation consultant code of conduct and agreement form

Evaluators:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation Consultant Agreement Form

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: José Antonio Cabo Buján

Name of Consultancy Organization (where relevant)**:** _____

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed in *Pontevedra (Spain) on* July 15th, 2020

Signature:

Tracking Tool for Climate Change Mitigation Projects
(For Terminal Evaluation)

Special Notes: reporting on lifetime emissions avoided

Lifetime direct GHG emissions avoided: Lifetime direct GHG emissions avoided are the emissions reductions attributable to the investments made **during the project's supervised implementation period** , totaled over the respective lifetime of the investments.
Lifetime direct post-project emissions avoided: Lifetime direct post-project emissions avoided are the emissions reductions attributable to the investments made outside the project's supervised implementation period, but supported by financial facilities put in place by the GEF project, totaled over the respective lifetime of the investments. These financial facilities will still be operational after the project ends, such as partial credit guarantee facilities, risk mitigation facilities, or revolving funds.
Lifetime indirect GHG emissions avoided (top-down and bottom-up): indirect emissions reductions are those attributable to the long-term outcomes of the GEF activities that remove barriers, such as capacity building, innovation, catalytic action for replication.
Please refer to the Manual for Calculating GHG Benefits of GEF Projects.

Manual for Energy Efficiency and Renewable Energy Projects
Manual for Transportation Projects

For LULUCF projects, the definitions of "lifetime direct and indirect" apply. Lifetime length is defined to be 20 years, unless a different number of years is deemed appropriate. For emission or removal factors (tonnes of CO2eq per hectare per year), use IPCC defaults or country specific factors.

General Data	Results at Terminal Evaluation	Notes
Project Title	Sugar Cane Renewable Electriciy (SUCRE)	
GEF ID	2778	
Agency Project ID	3515	
Country	Brazil	
Region	LCR	
GEF Agency	UNDP	
Date of Council/CEO Approval	June 12, 2010	Month DD, YYYY (e.g., May 12, 2010)
GEF Grant (US$)	7,800,000	
Date of submission of the tracking tool	December 22, 2012	Month DD, YYYY (e.g., May 12, 2010)
Is the project consistent with the priorities identified in National Communications, Technology Needs Assessment, or other Enabling Activities under the UNFCCC?	0	Yes = 1, No = 0
Is the project linked to carbon finance?	0	Yes = 1, No = 0
Cumulative cofinancing realized (US$)	70,408,900	
Cumulative additional resources mobilized (US$)	49,591,100	additional resources means beyond the cofinancing committed at CEO endorsement

Objective 1: Transfer of Innovative Technologies		
Please specify the type of enabling environment created for technology transfer through this project		
National innovation and technology transfer policy		Yes = 1, No = 0
Innovation and technology centre and network		Yes = 1, No = 0
Applied R&D support		Yes = 1, No = 0
South-South technology cooperation		Yes = 1, No = 0
North-South technology cooperation		Yes = 1, No = 0
Intellectual property rights (IPR)		Yes = 1, No = 0
Information dissemination		Yes = 1, No = 0
Institutional and technical capacity building		Yes = 1, No = 0
Other (please specify)		
Number of innovative technologies demonstrated or deployed		
Please specify three key technologies for demonstration or deployment		
Area of technology 1		
Type of technology 1		specify type of technology
Area of technology 2		
Type of technology 2		specify type of technology
Area of technology 3		
Type of technology 3		specify type of technology
Status of technology demonstration/deployment		0: no suitable technologies are in place 1: technologies have been identified and assessed 2: technologies have been demonstrated on a pilot basis 3: technologies have been deployed 4: technologies have been diffused widely with investments 5: technologies have reached market potential
Lifetime direct GHG emissions avoided		tonnes CO2eq (see Special Notes above)
Lifetime direct post-project GHG emissions avoided		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (bottom-up)		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (top-down)		tonnes CO2eq (see Special Notes above)

Objective 2: Energy Efficiency		
Please specify if the project targets any of the following areas		
Lighting		Yes = 1, No = 0
Appliances (white goods)		Yes = 1, No = 0
Equipment		Yes = 1, No = 0
Cook stoves		Yes = 1, No = 0
Existing building		Yes = 1, No = 0
New building		Yes = 1, No = 0
Industrial processes		Yes = 1, No = 0
Synergy with phase-out of ozone depleting substances		Yes = 1, No = 0
Other (please specify)		
Policy and regulatory framework		0: not an objective/component 1: no policy/regulation/strategy in place 2: policy/regulation/strategy discussed and proposed 3: policy/regulation/strategy proposed but not adopted 4: policy/regulation/strategy adopted but not enforced 5: policy/regulation/strategy enforced
Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds)		0: not an objective/component 1: no facility in place 2: facilities discussed and proposed 3: facilities proposed but not operationalized/funded 4: facilities operationalized/funded but have no demand 5: facilities operationalized/funded and have sufficient demand
Capacity building		0: not an objective/component 1: no capacity built 2: information disseminated/awareness raised 3: training delivered 4: institutional/human capacity strengthened 5: institutional/human capacity utilized and sustained
Lifetime energy saved		MJ (Million Joule, IEA unit converter: http://www.iea.org/stats/unit.asp) Fuel savings should be converted to energy savings by using the net calorific value of the specific fuel. End-use electricity savings should be converted to energy savings by using the conversion factor for the specific supply and distribution system. These energy savings are then totaled over the respective lifetime of the investments
Lifetime direct GHG emissions avoided		tonnes CO2eq (see Special Notes above)
Lifetime direct post-project GHG emissions avoided		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (bottom-up)		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (top-down)		tonnes CO2eq (see Special Notes above)

Objective 3: Renewable Energy		
Please specify if the project includes any of the following areas		
Heat/thermal energy production	1	Yes = 1, No = 0
On-grid electricity production	1	Yes = 1, No = 0
Off-grid electricity production	0	Yes = 1, No = 0
Policy and regulatory framework	3	0: not an objective/component 1: no policy/regulation/strategy in place 2: policy/regulation/strategy discussed and proposed 3: policy/regulation/strategy proposed but not adopted 4: policy/regulation/strategy adopted but not enforced 5: policy/regulation/strategy enforced
Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds)	0	0: not an objective/component 1: no facility in place 2: facilities discussed and proposed 3: facilities proposed but not operationalized/funded 4: facilities operationalized/funded but have no demand 5: facilities operationalized/funded and have sufficient demand
Capacity building	5	0: not an objective/component 1: no capacity built 2: information disseminated/awareness raised 3: training delivered 4: institutional/human capacity strengthened 5: institutional/human capacity utilized and sustained
Installed capacity per technology directly resulting from the project		
Wind		MW
Biomass	295.00	MW el (for electricity production)
Biomass		MW th (for thermal energy production)
Geothermal		MW el (for electricity production)
Geothermal		MW th (for thermal energy production)
Hydro		MW
Photovoltaic (solar lighting included)		MW
Solar thermal heat (heating, water, cooling, process)		MW th (for thermal energy production, 1m² = 0.7kW)
Solar thermal power		MW el (for electricity production)
Marine power (wave, tidal, marine current, osmotic, ocean thermal)		MW
Lifetime energy production per technology directly resulting from the project (IEA unit converter: http://www.iea.org/stats/unit.asp)		
Wind		MWh
Biomass	22,802,140.00	MWh el (for electricity production)
Biomass		MWh th (for thermal energy production)
Geothermal		MWh el (for electricity production)
Geothermal		MWh th (for thermal energy production)
Hydro		MWh
Photovoltaic (solar lighting included)		MWh
Solar thermal heat (heating, water, cooling, process)		MWh th (for thermal energy production)
Solar thermal power		MWh el (for electricity production)
Marine energy (wave, tidal, marine current, osmotic, ocean thermal)		MWh
Lifetime direct GHG emissions avoided	10,945,027	tonnes CO2eq (see Special Notes above)
Lifetime direct post-project GHG emissions avoided		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (bottom-up)		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (top-down)		tonnes CO2eq (see Special Notes above)

Objective 4: Transport and Urban Systems		
Please specify if the project targets any of the following areas		
Bus rapid transit		Yes = 1, No = 0
Other mass transit (e.g., light rail, heavy rail, water or other mass transit; excluding regular bus or minibus)		Yes = 1, No = 0
Logistics management		Yes = 1, No = 0
Transport efficiency (e.g., vehicle, fuel, network efficiency)		Yes = 1, No = 0
Non-motorized transport (NMT)		Yes = 1, No = 0
Travel demand management		Yes = 1, No = 0
Comprehensive transport initiatives (Involving the coordination of multiple strategies from different transportation sub-sectors)		Yes = 1, No = 0
Sustainable urban initiatives		Yes = 1, No = 0
Policy and regulatory framework		0: not an objective/component 1: no policy/regulation/strategy in place 2: policy/regulation/strategy discussed and proposed 3: policy/regulation/strategy proposed but not adopted 4: policy/regulation/strategy adopted but not enforced 5: policy/regulation/strategy enforced
Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds)		0: not an objective/component 1: no facility in place 2: facilities discussed and proposed 3: facilities proposed but not operationalized/funded 4: facilities operationalized/funded but have no demand 5: facilities operationalized/funded and have sufficient demand
Capacity building		0: not an objective/component 1: no capacity built 2: information disseminated/awareness raised 3: training delivered 4: institutional/human capacity strengthened 5: institutional/human capacity utilized and sustained
Length of public rapid transit (PRT)		km
Length of non-motorized transport (NMT)		km
Number of lower GHG emission vehicles		
Number of people benefiting from the improved transport and urban systems		
Lifetime direct GHG emissions avoided		tonnes CO2eq (see Special Notes above)
Lifetime direct post-project GHG emissions avoided		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (bottom-up)		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (top-down)		tonnes CO2eq (see Special Notes above)

Objective 5: LULUCF		
Area of activity directly resulting from the project		
Conservation and enhancement of carbon in forests, including agroforestry		ha
Conservation and enhancement of carbon in nonforest lands, including peat land		ha
Avoided deforestation and forest degradation		ha
Afforestation/reforestation		ha
Good management practices developed and adopted		0: not an objective/component 1: no action 2: developing prescriptions for sustainable management 3: development of national standards for certification 4: some of area in project certified 5: over 80% of area in project certified
Carbon stock monitoring system established		0: not an objective/component 1: no action 2: mapping of forests and other land areas 3: compilation and analysis of carbon stock information 4: implementation of science based inventory/monitoring system 5: monitoring information database publicly available
Lifetime direct GHG emission avoided		tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emission avoided		tonnes CO2eq (see Special Notes above)
Lifetime direct carbon sequestration		tonnes CO2eq (see Special Notes above)
Lifetime indirect carbon sequestration		tonnes CO2eq (see Special Notes above)

Objective 6: Enabling Activities		
Please specify the number of Enabling Activities for the project (for a multiple country project, please put the number of countries/assessments)		
National Communication		
Technology Needs Assessment		
Nationally Appropriate Mitigation Actions		
Other		
Does the project include Measurement, Reporting and Verification (MRV) activities?		Yes = 1, No = 0