**MIDTERM REVIEW**

***Sugarcane Renewable Electricity***

***Project BRA/10/G31***

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**Brasilia, JUNHO 2019**



**United Nations Development Program**

**Global Environment Facility**

PIMS: 3515

Project ID: 00064077

Project Award: 00051455

Project Duration: 2011-2019\*

\* In 2011-2014, Project implementation was suspended due to the need to change the Executing Agency

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| **Brief Description**The success of the Brazilian sugarcane-ethanol program is now well established, both in terms of achieving significant ongoing reductions in greenhouse gas emissions compared to petroleum fuel use. The Project reviewed here seeks to generate similar commercial and environmental success story with sugarcane-biomass electricity generation in Brazil.The Project is globally significant because among80 countries that grow sugarcane, Brazil is an international leader in technological innovation and competitiveness in sugarcane processing. Thus, success in Brazil would likely catalyze similar efforts in other countries. As biomass-based electricity production is already consolidated in the Brazilian sugarcane processing industries, where electricity generation meets onsite process requirements, the barriers to commercial success in electricity are much less daunting than at the initial stage of development of the sugarcane-ethanol program, although challenges remain regarding insertion of electricity into the national grid.The overall objective of the Project is to catalyze the establishment of a commercial market for sugarcane-based electricity to replace fossil-fuel electricity that would otherwise need to be generated to meet growing electricity demands in Brazil’s grid. The GEF helped lay the foundation for a cane-power industry in Brazil by sponsoring an earlier project (Biomass Power Generation – GEF ID 338) that was largely a technology development and capacity-building effort. The Sugarcane Renewable Electricity (SUCRE) Project builds on this earlier effort to catalyze the transformation of the sugarcane industry in Brazil into one for which supply of renewable electricity from sugarcane biomass to the grid becomes a significant core aspect of their business, alongside production of sugar and ethanol.To maximize the potential for electricity generation from sugarcane, the Project facilitates the expanded use of bagasse and sugarcane “trash” or straw, i.e. the tops and leaves of the sugarcane plant that historically have been burned on the field. The quantity of straw that is available on a typical cane field is equal to the amount of bagasse. Thus, considering straw and bagasse, the biomass resource from sugarcane is effectively double the amount commonly associated with sugarcane. This makes it possible to export large amounts of renewable electricity from sugarcane mills to the grid, when all of the additional biomass harvested is used for generation of additional electricity. In 2017, the mills that use biomass as a source of energy produced 25,482 Gwh for the national grid. The four partners from Batch 1 are generating and exporting to the grid 36% more than the PRODOC target, which was 180 MWh per year by three mills, according to SUCRE reports prepared to MTR evaluation. |

**Acknowledgements**

The evaluator thanks all those who contributed their knowledge and views to the preparation of this Midterm Review (MTR).

It is expected that the conclusions and recommendations that emerged from the analysis of all the data collected during the evaluation will contribute to the achievement of goals and improvement in other work.

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**LIST OF Acronyms**

ABC Brazilian Cooperation Agency

ACV-S Social Assessment of the Life Cycle

ANEEL National Agency for Electric Energy

APR-PIR Annual Project Review-Project Implementation Review

AWP Annual Work Plan

BAU Business-As-Usual

BNDES Banco Nacional de Desenvolvimento Econômico e Social, National Economic and Social Development Bank

CCEE Câmara de Comercialização de Energia Elétrica, Electric Power Trading Chamber

CENA Centro de Energia Nuclear na Agricultura, Center for Nuclear Energy in Agriculture

CNPEM National Center for Research in Energy and Materials

CONAB Companhia Nacional de Abastecimento, National Food Supply Company

CO2 Carbon Dioxide

COP Conference of the Parties

CTBE Brazilian Bioethanol Science and Technology Laboratory

CTC Centro de Tecnologia Canavieira, Sugarcane Technology Center

EE Electric energy

EMBRAPA Brazilian Agricultural Research Corporation

EPE Empresa de Pesquisa Energética, Energy Research Company

FINEP Financiadora de Estudos e Projetos, Studies and Projects Financing Agency

GEF Global Environment Facility

GHG Greenhouse Gas

GJ/t Gigajoule per ton

GNP Gross National Product

GWP Global Warming Potential

IPCC Intergovernmental Panel on Climate Change

IPP Independent power producer

IW Inception workshop

LAC Latin America and the Caribbean

LHV Low Heating Value

MAPA Ministry of Agriculture, Livestock and Food Supply

MCTIC Ministry of Science, Technology, Innovation and Communication

M&E Monitoring and Evaluation

MMA Ministry of Environment

MME Ministry of Mines and Energy

MRE Ministry of External Relations

MTR Midterm Review

NEX National Execution

OSCIP Civil Society Organization of Public Interest

PAC Project Advisory Committee

PB Project Board

PIR Project Implementation Review

PMU Project Management Unit

PRODOC Project Document

PSC Project Steering Committee

R&D Research and Development

SIRENE National Emissions Registry System

SUCRE Sugarcane Renewable Electricity

TM Technical Managers

ToR Terms of Reference

TPR Tripartite Review

UNDP United Nations Development Program

UNICA União da Indústria da Cana de Açúcar, Sugarcane Industry Union

US$ United States Dollar

**MTR Report: Starting December 2018 and ending April 2019**

[**Executive Summary**](#_Toc416275475)

**Project Summary Table**

**Project Title: BRA/10/G31 – Sugarcane Renewable Electricity (SUCRE)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Project ID: | 00064077 |  | *At endorsement (US$)* | *MTR* *(US$)* |
| PIMS: | 3515 | GEF Financing: | 7,800,000 | 7,800,000 |
| Country: | Brazil | IA/EA own: | 0 | 0 |
| Region: | RBLAC | Government: | 0 | 0 |
| Focal Area: | CC | Other: | CTBE: 3,750,000Mills: 55,800,000UNICA: 100,000 | CTBE: 3,203,674Mills: 151,724,138UNICA: 100,000 |
| FA Objectives, (OP/SP): | CC-SP3, CC-SP4 | Total co-financing: | 59,650,000 | 155,027,812 |
| Executing Agency: | CNPEM/CTBE | Total Project Cost: | 67,450,000 | 67,450,000 |
| Other Partners involved: | N/A | PRODOC Signature (date project began): April 20, 2015(Operational) Closing Date: Proposed: December 31, 2019  |

**Box 1**

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| To meet the objectives of the Sugarcane Renewable Electricity (SUCRE) Project, twelve mills were selected to identify the best technological processes for collection, transport, processing and use of sugarcane residues to produce electricity for each one. The mills were separated into two batches: a) Batch 1 was composed of the Quatá, Alta Mogiana, Pedra and Barra mills. In this first group the evaluations were more detailed. Various tests in the mills were planned and executed to generate numerical data to make possible the definition of the baseline configuration of each mill. Then several scenarios were created to simulate the impacts of the increase of trash use;b) Other mills of Batch 2 were also tested, but the evaluations were focused on facilitating the start or the increase of trash use. The main objective of this procedure is to identify the involvement of the Project’s partner mills and to identify how they use residues and how much electricity they now sell with the use of straw and bagasse. The detailed evaluations of each of the partner plants are in the project reports examined by this MTR. |

The Substantive Revision made in April 2015 is considered to be the new Project Document (PRODOC) since it included the necessary adjustments in the original PRODOC and in the budget due to the change of the Executing Agency. The change in legal status of the former Executing Agency (CTC) prevented the continuity of the project as originally envisaged and its implementation was suspended after signature in 2011. After an assessment undertaken by UNDP to determine the viability of the Project’s implementation by another institution, the Brazilian Bioethanol Science and Technology Laboratory (CTBE) was selected as the new Executing Agency starting in 2015 and implementation was extended until December 31, 2019. This revision also included the expenditures incurred by the Project in 2014.

The SUCRE Project was structured to produce technical reports as outcomesthat have provided the basis for the above-mentioned procedures. These outcomes as defined in the new PRODOC are presented in the box below.

**Box 2 – Outcomes**

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| **Outcome 1** Technology for sugarcane trash collection and conversion for electricity generation has been made operational for commercial use  ***Output #1.1*** *Process and equipment engineering for collection of sugarcane trash.* ***Output #1.2*** *Determination of the merits and constraints of technical solutions for trash collection and utilization.* ***Output #1.3*** *Installation and operation of (at least) one technical solution for sugarcane trash collection and utilization for electricity generation.* ***Output #1.4*** *Technical and process optimization of installed trash collection and processing system.***Outcome 2** The economic viability of sugarcane trash collection and utilization for electricity generation is demonstrated in commercial sugar mills. ***Output #2.1*** *Economic analysis of applicable trash collection and processing system in sugar mills.* ***Output #2.2*** *Evaluation of electricity generation scenarios based on combined bagasse/trash utilization by commercial sugar mills.* ***Output #2.3*** *Completed feasibility studies for sugarcane trash collection and processing investments in first batch (initially 3) of sugar mills.* ***Output #2.4*** *Expert assistance to support business development and PPA contracting by first batch of sugar mills.* ***Output #2.5*** *Monitoring of technical, economic and environmental performance of installed trash utilization systems in first batch of sugar mills.***Outcome 3** The effects of sugarcane trash collection on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long-term sustainability. ***Output #3.1*** *Integral assessment of the impacts of trash removal on the sugarcane production system, including soil quality, water usage, sugarcane yields, weeds, pests and diseases, etc..* ***Output #3.2*** *Expert assistance to support environmental licensing for first batch of sugar mills.* ***Output #3.3*** *Guidelines for environmentally acceptable implementation of trash utilization (collecting/processing).***Outcome 4** Sugarcane trash is being utilized across the sugarcane sector with private investment taking benefit from lessons learned. ***Output #4.1*** *A template has been developed for the appraisal of trash utilization projects by the sugarcane sector.* ***Output #4.2*** *Trash utilization systems for electricity production have been installed in the first batch of sugar mills (initially 3).* ***Output #4.3*** *Expert support has been provided to carry out feasibility studies for trash utilization systems in the second batch of sugar mills (initially 7).* ***Output #4.4*** *Investment for the second batch of sugar mills has been leveraged.* ***Output #4.5*** *Development of a database structure to support the implementation and dissemination of the project.* ***Output #4.6*** *Remote sensing as a tool to implement the system in mills.***Outcome 5** An adequate legal and regulatory framework is in place to promote the sustainable use of sugarcane trash for electricity generation and sales to the grid. ***Output #5.1*** *Updated study of regulatory barriers and opportunities related with the participation in the electricity market.* ***Output #5.2*** *Analytical support to sugarcane sector stakeholders regarding institutional, regulatory and legal aspects of electricity generation.* ***Output #5.3*** *Regulatory changes to support trash utilization for electricity generation are promoted for formal approval.***Outcome 6** Project monitoring, learning, adaptive feedback and evaluation. ***Output #6.1*** *Project monitoring and results evaluation.* ***Output #6.2*** *Lessons learned and adaptive feedback.***Outcome 7** Project management. ***Output #7.1*** *Project management.* |

**MTR Rating & Achievement Summary**

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| Measure MTR Rating Achievement Description |
| Project Strategy | N/A |  |
| Progress Towards Results | ObjectiveAchievement Rating: (rate 6 pt. scale) **5 (S)** | The objective is close to being fully achieved and can still involve some wider dissemination, capacity building and replication as well as promoting change in the regulatory framework for marketing of low GHG electricity. |
| Outcome 1Achievement Rating: (rate 6 pt. scale) **6 (HS)** | Technology has been made operational for commercial use. |
| Outcome 2Achievement Rating: (rate 6 pt. scale) **6 (HS)** | Economic feasibility for commercial use of sugarcane energy has been demonstrated. |
| Outcome 3Achievement Rating: (rate 6 pt. scale) **6 (HS)** | Effects on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long-term sustainability. |
| Outcome 4Achievement Rating: (rate 6 pt. scale) **6 (HS)** | Sugarcane residues are being utilized in the sugarcane sector with private investment taking benefit from lessons learned. |
| Outcome 5Achievement Rating: (rate 6 pt. scale) **5 (S)** | An adequate legal and regulatory framework is not yet in place to promote the sustainable use of sugarcane residues for electricity generation and sales to the grid. |
| Outcome 6Achievement Rating: (rate 6 pt. scale) **6 (HS)** | Project monitoring, learning, adaptive feedback and evaluation are being carried out. |
| Project Implementation & Adaptive Management | (rate 6 pt. scale) **6 (HS)** | Project implementation and adaptive management has been highly satisfactory, but a time extension is needed. |
| Sustainability | (rate 4 pt. scale) **4 (L)**  | Project sustainability is likely because of wide-reaching private sector partnerships. |

Source: Ratings established according to: Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects.

According to the Evaluator, the rating of the project *as a whole* is **Highly Satisfactory (HS)**, meaning that the project had only minor shortcomings.

**Conclusions, Recommendations and Lessons Learned**

According to this MTR, implementation of the SUCRE Project has been satisfactory. Among the success factors and best practices, the key points were the establishment of public- and private-sector partnerships as the principal means of implementation, mobilizing multiple sources of cash and in-kind co-financing. Various studies and experiments, be they theoretical, in laboratories or in the field, were relevant. This success in achieving outputs and outcomes to obtain defined objectives occurred both because of setting up a coordination unit for the preparation of experiments and defining technologies to offer to the mills and because of the involvement of experts from various public and private sector organizations. Project finalization and sustainability still require efforts to achieve some products and results, mainly related to dissemination and replication activities.

The Project successfully changed many procedures and technologies and replaced them with more appropriate innovations. The Project team organized technical and economic information that previously was dispersed, disorganized or incomplete. This required research and experiments regarding quality of the sugarcane straw and possible impacts on the environment and the boilers. Partners such as mills and equipment and boiler manufacturers as well as associations were involved in working more carefully and reliably with sugarcane straw for electricity generation in order to find innovations to overcome the various technological barriers. In 2017, the mills that use biomass as a source of energy produced 25,482 Gwh for the national grid. The four partners from Batch 1 are generating and exporting to the grid 36% more than the PRODOC target, which was 180 MWh per year by three mills, according to SUCRE reports prepared to MTR evaluation.

The evaluation of the activities already carried out by the Project with the complete engagement of the team and of the experts in related areas verified that more than 70 agronomic, industrial and straw transport experiments were carried out as described in the progress reports. Many laboratory analyses were performed. All of these activities were carried out so as to contribute to the main target group of this project, namely the 14 partner plants of the Project located in the state of São Paulo and the region.

The challenges faced by the Project were the need for technological advances in the collection and conversion of sugarcane straw to reduce equipment maintenance costs, besides reducing costs caused by inefficiency in burning and incrustations and deposits of impurities in boilers. The challenges were mainly related to the high content of mineral impurities and the low efficiency of Dry Cleaning Systems (SLS) to remove contaminants found in the straw and in the soil. The solutions found were part of the results-oriented activities foreseen in the project document and were developed in an efficient way.

Other benefits of the activities developed have to do with the agronomic impacts of sugarcane straw removal. The analyses carried out by the Project generated better understanding of the impacts on the soil and on the water resources used in straw processing.

Reducing greenhouse gas emissions, a global priority of GEF, was a major concern to be addressed. The Project team, assisted by hired experts, identified the emissions due to the production of ethanol. The avoided emissions for 2017 were 10.32 gtCO2eq. It was found that straw increases the N2O emissions from fertilizers and vinasse. Although there are still few studies on this subject, the Project proposes to do research on the problem and if it cannot present a complete solution at the moment, it has a proposal to minimize the problem.

The evaluator identified valuable information contained in the Project progress reports and in published documents that contained inputs from experiments, studies and analyses. The Project team also identified that the ethanol emission balance studies carried out in Brazil using the “default” value proposed by the Intergovernmental Panel on Climate Change (IPCC) need more studies. It is the intention of the team to carry out studies with the collection of data and information to calculate the actual values and make comparisons with other sources.

Other studies on the potential of sugarcane straw use were also carried out by the Project team, including the establishment of methodology for mapping and guidance of good practices for the removal of straw and the existence of pests and diseases that may affect productivity.

All these activities were key for the successful implementation of the Project and its potential for application in other regions and countries. This is due both to the work and composition of the execution team and the commitment of the Project’s coordination unit. In addition, the involvement of experts contracted by the Project and their work to evaluate the procedures applied by the partner plants have led to greater efficiency in the production of energy from the processing of sugarcane residues. Obtaining renewable alternative energy that generates economic and social benefits is the way to be followed in the search for efficient results. The evaluations and analyses carried out by the Project were important inputs for decisions regarding purchase of equipment and materials to provide the sugarcane mills with greater possibilities of increased production.

All the activities developed and the results found and transmitted to the partners are expressed and contained in the progress reports of the Project. Many are also contained in academic articles, as well as 19 bi-monthly newsletters published and disseminated not only to the target public of the Project, but also to the various stakeholders involved (<https://pages.cnpem.br/sucre/newsletter-sucre/>).

The evaluation also identified the dissemination of new proposals for the collection and processing of sugarcane straw for the generation of electric energy. New straw collection procedures were transmitted as lessons learned by the Project and led to reduced transportation costs, such as straw chopping in the field instead of the plant. All these established procedures were transmitted in seminars or written documents, generating significant economic, social and environmental benefits.

The review of the Project activities and its results was aimed at judging the importance of its actions, drawing lessons learned and proposing recommendations. In conclusion, the Midterm Review evaluator can attest that the Project has been carried out efficiently and that the issues studied and analyzed are of paramount relevance to local, regional and national development. In addition, the Project results have contributed globally to reducing the impacts of climate change and meeting GEF objectives.

**Lessons Learned**

Some lessons can be drawn from the experiments, studies and analyses carried out. Among them, the Evaluator highlights the following:

- The lessons learned from the search for technologies to collect sugarcane residues for electricity generation and to insert this energy in the market, with various studies and analyses about the economic viability of the commercialization of energy from sugarcane biomass and about the impacts of the collection of sugarcane residues on the crop and harvest cycle, on the environment and on production sustainability.

These lessons were fundamental to respond to the methodological issues and the efforts of dissemination of the knowledge acquired by the technical-economic and environmental evaluations: modeling with data validated by partners, customization and scenarios for the expansion of straw collection for the production of bioelectricity.

- Lessons learned from research methodologies in the field and industry, providing an overview of the issues involved the need to raise awareness of the importance of using appropriate and innovative technologies.

- The dissemination of the lessons learned led some plants to participate effectively and become interested in:

* costs of straw collection;
* potential for additional electricity generation;
* additional revenue and impact on co-products;
* proposals of industrial equipment layout and estimated investment;
* agro-industrial costs and minimum selling price of electricity from straw; and
* surveying the potential for reducing greenhouse gas emissions compared to non-collection and electricity from other sources.

- Lessons learned also led to the construction of tools such as the calculator offered for use by the partners for preliminary evaluation of the use of straw in the generation of bioelectricity. This tool providing integrated modeling prepared by the CTBE team can be used after the end of activities, being important for sustainability.

- Project actions also generated lessons about the mitigation of GHG emissions, identifying that emission reduction would be 11% with the production of bioelectricity, considering the total emissions from the energy sector in Brazil.

- Other lessons are related to the effects of expansion of sugarcane on deforestation and availability of water resources. For water, the results showed that sugarcane has a positive regulating effect as compared to annual crops and pasture. According to data collected by the Project team, there was an increase of up to 10% in water availability in the watersheds.

- The MTR also emphasizes the lessons learned about various social impacts of sugarcane straw collection, going beyond what was originally planned. These lessons came from the Social Assessment of the Life Cycle (ACV-S) and the Input-Output Analysis using social impact indicators compared to other renewable or non-renewable energy sources.

Some lessons learned central to the success of the SUCRE Project came from the suggestions and contributions made in the evaluation reports regarding energy sector regulatory milestones. The results produced inputs for the preparation of the Bioelectricity Booklet that has as its content: modalities of sale of renewable electricity; interconnection to the national electricity grid; preparation of the letter of suggestions on marketing and standards; inputs for meetings with the Ministry of Mines and Energy (MME) and other institutions; and ways to strengthen the partnership with the Sugarcane Industry Union (UNICA). This initiative helps leverage engagement with the private sector and involvement of other technical research and innovation centers.

**Recommendations**

Some recommendations made or included by the MTR are as follows:

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| **Recommendations** | **Entity Responsible** |
| Extend the expiration date of the Project until December 31, 2020, as justified in this MTR, which identifies reasons for delay in agreement with the proposed work schedule presented by the National Project Director (NPD) and approved by the Project Advisory Committee (PAC) and sent to GEF/UNDP for approval and then to ABC, with attention to exit strategies involving other actors. | SUCRE TeamGEF/UNDPABC/MRE |
| Consider the suggestion made by this MTR and UNDP/Program Office to include in the PAC subgroups of discussion on the Project related topics, such as bioelectricity and renewable energy.  | SUCRE Team |
| Conduct a revision of the regulatory framework of the national electricity sector including the sector of bioelectricity and other public policies and hold discussions through seminars or workshops, ensuring strong contributions by Project partners and stakeholders. | SUCRE Team and UNICA Representative |
| Plan and implement increased communication through various media and events in Brazil and abroad of academic and applied research on the conditions under which sugarcane residues are used for electricity generation, including more data on the scenario in which biomass removal may impair soil fertility and influence soil erosion. | SUCRE Team and experts |
| Increase efforts to involve other ministries, such as Mines and Energy (MME), Agriculture (MAPA) and Environment (MMA). | SUCRE Team/UNICA and other partners |
| Clarify that the sugarcane agriculture in the area covered by the Project is not a direct cause of deforestation, since it is carried out in areas already deforested and used for pasture or crops. | SUCRE Team |
| Increase efforts to replicate the sustainability and continuity of the activities developed by the Project in other areas or regions of Brazil where there are sugarcane plantations and processing plants. | SUCRE Team with partners support |
| Prepare a plan to disseminate the information obtained through the execution of the Project, as well as on successes and challenges faced in the consolidation of alternative renewable energy generation. | SUCRE Team |
| Promote and carry out national and international seminars for broad dissemination of the Project experiences. | SUCRE Team with partners support |
| Prepare plan for replication of the activities developed by the Project, taking into account local specificities and presenting the successes and challenges facing the sector.  | SUCRE Team |

The corrective actions, follow-up, future directions and best and worst practices are as follows:

**Corrective actions for the design, implementation, monitoring and evaluation of the project**

This Project is near conclusion, but there is need for greater attention to ways to deal with the regulatory barriers to the commercialization of electricity generated by sugarcane mills. Include in the Project design more effective means of promoting dialog with government institutions, involving the project team, UNICA, mills and ministries of Agriculture (MAPA), Mines and Energy (MME) and Science, Technology, Innovation and Communication (MCTIC) and their agencies like the Energy Research Company (EPE) and the National Agency of Electric Energy (ANEEL), among other stakeholders.

**Actions to follow up or reinforce initial benefits from the project**

From now on, wide dissemination of the results to decision-makers and the public should reinforce initial benefits from the Project. Additional benefits can be achieved by making full use of the data collected in the field and in industrial experiments.

**Proposals for future directions underlining main objectives**

Future directions could include continuation and deepening of the engagement of other institutions related to renewable energy, as mentioned above, as well other private organizations and local governments, especially those working with environment and alternative energy at the local, state and regional levels.

**Best and worst practices in addressing issues relating to performance and success**

The best practices involved contributions by a wide range of partners and stakeholders, including universities and students, who then continue working on the subject in years to come. No worst practices were found.

[**1 Introduction**](#_Toc416275476)

The National Alcohol Program (PROALCOOL), created in 1975, was successful in significantly replacing petroleum derivatives with ethanol. The objective of the program was to stimulate the production of alcohol in order to meet the needs of internal and external markets and implement the new policy of automotive fuels. The program is currently consolidated both in terms of commercial competitiveness and in terms of reducing greenhouse gas emissions.

The SUCRE Project, which began execution in 2015, seeks to achieve, as in the case of the National Alcohol Program, commercial and environmental success with the generation of electricity from sugarcane biomass. The biomass residues from sugarcane are transformed into electric power using appropriate technology and equipment. Thus, sugarcane produces energy for humans and ethanol fuel for machines. In addition, the material leftover from this process, bagasse and sugarcane straw, is also transformed into energy. The processed biomass generates thermal energy, which in turn generates electric energy. The cogeneration of energy from the bagasse and straw supplies power for the plant itself and generates a surplus that can be sold on the market. In 2017, the mills that use biomass as a source of energy produced 25,482 Gwh for the national grid. The four partners from Batch 1 are generating and exporting to the grid 36% more than the PRODOC target, which was 180 MWh per year by three mills, according to SUCRE reports prepared to MTR evaluation.

The SUCRE Project is globally significant. Among approximately 80 countries that grow and process sugarcane, Brazil is a leader in technological innovation and competitiveness. The success of sugarcane biomass energy in Brazil could be replicated in other countries.

In the first stages of the transformation process of sugarcane products into bioenergy, some technical difficulties that limited operations arose. However, during the execution of the SUCRE Project, the challenges were dealt with. Cogeneration of energy has been obtained by the grinding of sugarcane straw that is put together with the bagasse used in the boilers for steam generation.

The general objective of the SUCRE Project is to catalyze the establishment of a commercial electricity supply market based on sugarcane for the Brazilian electric power grid. This renewable energy has the potential to replace the use of fossil fuel energy that in recent times of crisis of hydroelectric plants was needed to meet the demand for electricity in Brazil.

The GEF supported the establishment of the bases for the sugarcane energy industry in Brazil through the GEF ID 338 Biomass Energy Generation Project, an effort to develop technology and build capacity. SUCRE was based on this previous effort to catalyze transformation of the sugarcane industry through use of biomass for generation of electric power using innovative technologies.

To maximize the potential for electricity generation from sugarcane, the SUCRE Project developed technologies that promote the expanded use of bagasse by adding sugarcane straw. The amount of this material available in the fields of sugarcane plantations, once considered “waste”, has been quantified as equivalent to the amount of bagasse produced. Thus, considering “waste” and bagasse, the biomass resource of sugarcane is effectively twice the resource commonly associated with sugarcane. The result has been the obtaining of large quantities of renewable electric power that can be exported from sugar mills to the grid.

The process of power cogeneration with the addition of straw to the bagasse has received support from the SUCRE Project with field research and definition of better and more suitable technologies for the piling, cleaning and baling of straw. After the field procedures, the straw is added to the bagasse burned in the boilers for generation of the high-pressure steam that drives the turbines of the power generators.

In 2015, at the beginning of the implementation of the SUCRE Project, the energy supply obtained from biomass in Brazil, according to data from the Sugarcane Industry Union (UNICA), grew by 7%, generating a total of more than 22 TWh, equivalent to the supply of 11 million households for a full year. Currently, the installed capacity for the generation of electricity from biomass comes from the sugarcane-energy sector, using sugarcane bagasse and straw and offering the surplus electricity to the National Interconnected System (SIN). In the same year, it was estimated that, in environmental terms, the generation of renewable energy by biomass would prevent the emission of approximately 10 million tons of CO2.

According to a representative of UNICA, the renewable energy from the biomass of sugarcane processing offered to the SIN from January to August 2018 was equivalent to having avoided the emission of more than 5 million tons of CO2, an amount that could only be reached with the cultivation of 36 million trees over 20 years. Furthermore, because generation continues during the dry period, there was 12% more water in the hydroelectric reservoirs of the Southeast and Center-West regions, where almost 60% of the country’s electricity is consumed.

In addition, the bioelectricity offered in July 2018 corresponded to 7.8% of the country's energy consumption, an increase of 11% in relation to the volume produced in the same period of 2017, according to a survey conducted by UNICA using data from the Electric Power Trading Chamber (CCEE).

The potential for biomass (sugarcane bagasse, straw and other waste) to generate electricity is enormous, but there is a need for well-structured public policies, as well as a suitable regulatory framework consistent with the importance of the sugar and alcohol sector so that investments in the sector are worthwhile.

This potential for biomass energy generation may be of great importance for the fulfillment of goals agreed on by the Brazilian government at COP21. The proposal presented by Brazil, considered bold at the time, was a reduction of 43% in greenhouse gas emissions (GHG) by 2030, compared to 2005 emissions, in addition to the use of 45% of renewable energy. Therefore, investment in the production of electric energy from biomass or bioelectricity will be of paramount importance to the energy matrix.

It can be concluded that currently a large part of the installed capacity of energy generation using biomass sources comes from the sugar-energy sector, which uses bagasse and sugarcane straw for the energy self-sufficiency of the plants and has also promoted significant growth in the supply of electricity surplus to the SIN.

In this way, the SUCRE Project has achieved relevant results as foreseen in the Substantive Review 1, considered as the new PRODOC, which are:

**Outcome 1** treated the technology barriers for the collection, processing and use of electricity generation at an early stage of development and a lack of cases to demonstrate that the use of trash for electricity generation is a technically feasible alternative.

The Project seeks to overcome the technological challenges in the field and in the industry in order to make possible greater use of sugarcane straw in cogeneration. For this, the team works to identify and solve the problems that prevent the partner mills from generating electricity in a complete and systematic way. The SUCRE team works on seven work fronts (Outcomes) that pursue the following results:

**Outcome 2** is about the economic feasibility of collecting, transporting and processing of residues which had not yet been demonstrated in commercial cases, and the unfavorable financing conditions due to the uncertainties of such use.

**Outcome 3** deals with the effects of sugarcane trash collection on cultivation and the harvesting cycle to ensure environmental integrity and long-term sustainability. The barriers identified were related to the perception that the use of biomass for energy could be environmentally harmful. Therefore, field experiments were carried out to quantify the environmental and agronomic impacts of gathering, transporting, processing and using trash for electricity generation. They were documented and updated to be used as the basis for establishing a set of Good Practices to guarantee sustainability of the process.

**Outcome 4** deals with sugarcane trash being utilized across the sugarcane sector with private investment using lessons learned. The barriers were the lack of technical-economic information for investors who might invest in trash projects for electricity generation, the lack of early adopters of the technology in a scenario of plants that are conservative and follow the safest models until the return is demonstrated, the perception that investors and financial institutions have about the risks of the use of electricity from trash and the lack of information available to the main stakeholders regarding the technical, economic and environmental impacts of the implementation of trash systems for electricity generation.

**Outcome 5** is about the lack of adequate legal and regulatory frameworks to promote the sustainable use of sugarcane trash for electricity generation and sales to the grid. The main barriers were the insufficient understanding in the sugar and ethanol sector regarding the legal, regulatory and market aspects of the sale of energy and the existence of laws and practices that discourage the sector from connecting to the grid.

**Outcome 6** refers to project monitoring, learning, adaptive management and evaluation; and

**Outcome 7** is about the process of project management.

To meet the SUCRE Project objectives, twelve mills were selected to identify the best technological route for each one for collection, transport, processing and use of sugarcane trash to produce electricity. The mills were separated into two batches defined as:

1. **Batch 1** was composed of the Quatá, Alta Mogiana, Pedra and Barra mills. In this first group the evaluations were deeper and more detailed, and several tests in the mills were planned and executed to generate numerical data to make possible the definition of the baseline configuration of each mill. Several scenarios were then created to simulate the impacts of the increase of trash use; and
2. **Batch 2** included other mills to be tested, but the evaluations were focused on facilitating the start or the increase of trash use.

The main objective of this procedure is to identify the involvement of the Project’s partner mills and to identify how they use trash and how much electricity they sell today with the use of trash and bagasse. More detailed evaluations of each of the partner plants can be found in the project reports examined by this MTR.

[**1.1** **Purpose of the Midterm**](#_Toc416275477) **Review**

The MTR assesses progress towards the achievement of the Project objectives and outcomes as specified in the new PRODOC as well as early signs of project success or failure with the goal of identifying the changes needed in order to set the Project on-track to achieve its intended results. The MTR also reviews the Project’s strategy and its risks to sustainability.

Thus the purpose of this MTR is to analyze the implementation, results and products achieved to date and others to be developed related to the successes of the SUCRE Project. In addition, it intends to identify the lessons learned so far and that can improve the sustainability of its actions and propose recommendations that can complement the performance and achievement of the Project objectives.

The overall objective of SUCRE Project is to catalyze the establishment of a commercial market for sugarcane-based electricity supply to the Brazilian grid, to displace fossil-fuel electricity that would otherwise need to be generated to meet growing electricity demands and shortages of hydropower in Brazil. The GEF helped lay the foundation for a cane-power industry in Brazil by sponsoring an earlier project that was largely a technology development and capacity-building effort. The SUCRE Project builds on this earlier effort to catalyze the transformation of the sugarcane industry in Brazil into one for which supply to the grid of renewable electricity from sugarcane biomass becomes a significant and core aspect alongside sugar and ethanol production.

[**1.2** **Scope and Methodology**](#_Toc416275479) **of the Midterm Review**

**1.2.1 Scope**

By identifying and analyzing the documentation of Project BRA/10/G31 activities, the MTR also provides findings and recommendations and suggests ways to improve activities related to the Project scope as contributions to its continuation.

In addition to the purposes indicated above, the objective of this MTR is to present to public and private institutions all Project evidence and recommendations that emerge from the analysis of documents and procedures recommended and adopted, visits to the institutions involved in Project implementation, interviews with experts and those responsible for Project BRA/10/G31 actions and results.

 **1.2.2 Midterm Review Methodology**

The MTR reviewed all relevant sources of information such as the UNDP Project Document (PRODOC), Project Implementation Review (PIR), Annual Work Plan (AWP), Progress Reports, project budget revisions, national strategic and legal documents and other materials that the team considered useful. In addition, this evaluation analyzes electricity procedures and norms, included visits institutions involved in project execution and carried out interviews with the team involved in the Project activities and those responsible for implementing the BRA/10/G31 Project.

The MTR report must follow the UNDP Discussion Paper Innovations in Monitoring & Evaluating Results and must reflect the engagement of stakeholders, according to the UNDP Handbook on Planning, Monitoring and Evaluation for Development Results. To accomplish the purpose, the Evaluator interviewed the Project partner mills from Batch 1 and 2 and key experts in the subject area and conducted field missions and other procedures defined by UNDP and CTBE/CNPEM responsible for Project implementation.

The methodology and approach developed reflects the challenges, risks, strengths and weaknesses faced in the implementation of the Project, which are inputs to the proposed conclusions and recommendations.

The completion of this Evaluation has been possible through the selection of a consultant by UNDP/CTBE, based on pre-established terms of reference. The duties and qualifications of this consultancy are in Annex 5.1. This consultant established a work plan based on the Terms of Reference in Annex 5.2.

The MTR process included data collection through interviews, meetings, visits to institutions and analysis of relevant technical and administrative-financial documents provided by project teams to obtain information on project execution procedures. The data collected in the field allowed for the formulation of objective questions with flexibility.

The main actors involved in the management of Project BRA/10/G31 at MCTIC and more than a dozen other partner institutions were interviewed. The list of respondents is in Annex 5.3. The analysis of progress reports and other project implementation documents and relevant academic documentation were the basis for analysis and preparation of this MTR.

As for the ethical aspects, in this report the informants are not mentioned by name.

[**1.3 Structure of the Midterm Review Report**](#_Toc416275480)

 **1.3.1 Structure of the Midterm Review Report**

The structure of the Midterm Review Report follows guidelines, standards and procedures established by UNDP and contained in the Guidance for Conducting Midterm Reviews of UNDP-Supported GEF-Financed Projects. The structure contains:

* Executive Summary;
* Introduction with overview, problems, objectives, indicators, stakeholders and partial results;
* Findings that emerged from partial implementation of the Project; and
* Recommendations.

**1.3.2. Criteria for the Assessment and Key Issues to be Analyzed**

The overall key issue that permeates the SUCRE Project MTR is to address the proposition: how to respond and undertake any and all efforts to catalyze the establishment of a commercial market for sugarcane-based electricity supply to the Brazilian grid, to displace fossil-fuel electricity that would otherwise need to be generated to meet growing electricity demands in Brazil? How to understand and act to preserve the planet’s atmosphere from GHG emissions that result in significant socioeconomic and environmental vulnerabilities? These concerns are part of Brazil’s commitments as a signatory to the Paris Agreement.

The project has an important complementary contribution to make to Brazilian climate change policies, emissions mitigation options, reduction of vulnerabilities and ways of adapting to climate change.

The report analyzes the assessment criteria laid down in the document and contained in the Guidance for Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects, namely efficiency and sustainability and other aspects as per guidelines: assessment of progresstowards results; monitoring of implementationand adaptive managementto improve outcomes; early identification of risks to sustainability; emphasis on supportive recommendations.

* Efficiency: Did the Project and its activities lead to the disbursement of financial resources and actions of human resources with minimal waste, in order to achieve the outcomes and partial outputs in the context of the whole project? Has the Project been implemented efficiently, in accordance with international and national norms and standards?
* Sustainability: Did the project offer financial and institutional and governance conditions to continue efforts during and after the period of its implementation?

**2. Project Description and Development Context**

This item explains the process of Project formulation and the basis for definition of the components and activities needed to achieve the proposed objectives. This project description and development context deals with sugarcane planting and processing.

Sugarcane has been planted in Brazil for nearly five centuries. The first samples were brought from Africa to São Vicente in São Paulo in 1532 and taken to the state of Pernambuco in 1535, before spreading all along the Atlantic coast including Bahia and Rio de Janeiro. After that, Pernambuco and São Paulo became the two major centers for sugarcane production. In recent history the state of São Paulo has taken the lead as Brazil’s most important sugarcane producing region.

The success of PROÁLCOOL, the ethanol program in Brazil begun in the 1970s, was due to the commitment of the Brazilian government to boost sugarcane planting mainly in São Paulo. The planted area covers ​​about 6 million hectares, in which about 442 million tons of sugarcane has been produced, according to data from IBGE in 2016.

Today the success of the Brazilian sugarcane-ethanol program is well established, both in terms of being commercially competitive and in terms of achieving significant ongoing reduction in GHG emissions as compared to petroleum fuel.

The development of the sector was not only due to programs and projects of the Brazilian government, but also to the organization of the producers and the need for alternative fuel sources.

Currently, Brazil is one of the world's largest producers of sugarcane, with São Paulo accounting for 55% of the area planted in the country. Sugarcane processing plants in the state of São Paulo can choose to produce sugar or ethanol, which is a competitive advantage of the sugar and alcohol sector in relation to other countries.

According to the site invests.sp.gov.br, plantations in São Paulo have high productivity per hectare. This is due, in addition to soil quality and favorable climatic conditions, to research conducted by public and private research institutes such as the Center for Sugarcane Technology (CTC).

The 172 mills in the state correspond to 42% of the total for Brazil and were responsible for 56% of the sugarcane crushed nationally in the 2016/2017 harvest according to data from UNICA. These plants produce a large part of the ethanol used in flex-fuel vehicles common in Brazil, benefitting the planet by reducing GHG emissions.

The SUCRE Project was designed to take advantage of the by-products of sugarcane in addition to the production of ethanol and sugar. It is intended to catalyze the transformation of the sugarcane industry in Brazil into one for which supply to the grid of renewable electricity from sugarcane biomass becomes a significant and core aspect of the business, alongside sugar and ethanol production.

To maximize the potential for electricity generation from sugarcane, the Project facilitated the expanded use of bagasse or fiber from cane stalks that is already used for heat and power generation and launches the widespread use of sugarcane “trash” or straw.

**2.1 Project Start and Duration**

The BRA/10/G31 Substantive Review 1, here considered to be the new Project Document (PRODOC), was approved in 2015. It was undertaken because the Center for Sugarcane Technology (CTC) was no longer eligible to be the executing agency. The activities began in April of that year, with project finalization scheduled for December 2019.

**2.2 Problems that the Project Sought to Address**

The South, Southeast and Center-West regions are responsible for most of the sugarcane cultivated in Brazil for sugar and ethanol production. They are also the regions where mechanization of the sugarcane harvest has grown rapidly. In this way, the activities of the SUCRE project were formulated for these regions, where it was possible to install electricity generation systems through the processing of sugarcane straw.

In 2006/2007, according to the new PRODOC, these regions accounted for 65% (326 million tons) of sugarcane produced for sugar or ethanol fuel. In 2015, 40% (130 million tons) of sugarcane in this region was harvested green (without pre-burning) and 80% of the waste generated in the green harvest was left in the field. The remaining 20% of the residue mixed was washed away with green cane and brought to the plants.

The SUCRE Project has the specific objective of eliminating the barriers to the use of most sugarcane residues, including straw, leaves and others, for the generation of electric energy. The barriers or problems identified were of a technical and financial nature as well as lack of information and awareness about specific regulatory rules for electric energy produced by the burning of sugarcane residues added to the bagasse.

According to the problems and justifications for the Project implementation, the main reason for not collecting and using these residues was the absence of adequate and commercially accepted technology to collect, transport and process them in the plants where they could be used to produce heat and power.

Thus, the main reasons for the waste of sugarcane residues and non-generation of energy were technological problems or barriers that prevented the additional use of biomass in the generation of electric energy. According to the new PRODOC, technological barriers were not only related to the collection of additional amounts of residues from sugarcane cutting. The inclusion of crop residues in the bagasse fuel mixture that fed the boilers required precise and adequate adjustments and procedures to ensure good performance of the generation system under various conditions present in different plants. This required the identification and solution of all possible technological problems to reduce the risk of system inefficiency or malfunction.

The problems identified and explained in the new PRODOC were due to lack of knowledge and information about technologies and procedures needed to obtain energy from sugarcane residues. Several sugarcane mills had already seriously considered use of this material, such as the Nova América, Da Barra, Da Pedra, São Luís Dedini, São Martinho, Barra Grande, São José ZL, Quatá and São Francisco mills (all in the State of São Paulo), which had already tried to recover it for use as a supplementary fuel for boilers, but without success.

The Sugarcane Technology Center (CTC), which would initially have been the executing agency for the SUCRE Project, supported these initiatives by providing information and technical assistance based on the experience gained in the implementation of the GEF-supported "Biomass Energy Generation Project". However, most experiments were restricted to testing in small areas and lasted only a few months. In all experiments, the main reason for stopping was the lack of reliable information about the technology to be employed, equipment operation and process costs, including investment, operation and maintenance of the plant boilers.

The abandonment of the experiments made clear the seriousness of the problems of lack of information and the need for a more comprehensive intervention to demonstrate the commercial viability of the proposal that underpinned the formulation of the SUCRE Project.

According to the new PRODOC, without proven technology and adequate information on investment costs and requirements, it was difficult to approach financial institutions such as National Economic and Social Development Bank (BNDES) to secure the type of financial support needed to modify the facilities of the sector and acquire equipment to process sugarcane residues for electric power generation.

Yet another problem arose from the difficulties of obtaining the necessary financial support for commercial use of these residues. BNDES, according to the PRODOC, offered financial support at lower interest rates for technologies that would bring greater efficiency to less efficient boilers, but not to those that could process residues associated with sugarcane bagasse. Therefore, the search for and availability of proven technology and adequate information on the proposed processing was part of the SUCRE Project objectives, in order to overcome the financing barrier for investment in the generation of electric energy from sugarcane residues.

Unlike other countries, Brazil has a regulatory framework to support private energy-generating enterprises since 2000. This structure includes procedures for the sale of electricity from sugarcane bagasse to the power grid at profitable rates for the mills. Up to 2015, sugarcane mills have been gradually increasing their energy generation in response to the best prices paid for their electricity. However, electricity exports to the grid were still small, with only 10% of the mills participating in the electricity market.

In addition, this process took place without full consideration of the different perspectives, problems and interests of the parties involved, i.e. the sugar industry, marketing companies and government. The sugarcane mills lacked good understanding of the functioning of the electricity market and its particularities.

Thus, according to the new PRODOC, the rules of the institutional model of the electricity sector did not motivate the existing sugarcane mills to generate electricity or use residues as complementary fuel. The rules are being modified slowly to support the introduction of new sources of energy into the electric system.

Various other barriers that did not allow a fully developed market for the sale of electricity from sugarcane mills to the national electricity grid were identified. One of the problems in the rules of the “new” electricity auctions was that a plant would only increase its total production capacity over several years, but it would be necessary to start selling electricity to the grid well before reaching its full capacity.

However, under existing auction rules, any energy generated in subsequent years after the first year of engagement in the system would be counted as coming from an “existing facility” and could not be sold through auctions as “new electricity”, which brought higher sales prices. To circumvent this restriction, some mills have divided their ventures into two or three distinct units in the same location. This sales strategy was less efficient than electricity from a single unit. This rule generated unnecessary economic and energy inefficiency.

With regard to sugarcane residues, it became clear that their use was more expensive than the use of bagasse, since it had no other value for the plant than a source of fuel. However, the electricity price calculations made and presented at the time of the formulation of the SUCRE Project did not consider these factors, but only the price of the fuel as zero. New calculations were needed for the Substantive Review.

Another important problem identified in the new PRODOC was the distance that needed to be covered by power lines from some plants to a point of connection to the grid. These plants require investment for such connection. In some cases, the distances were enormous and the additional investment required made it impossible for the plant to compete in auctions. These plants, therefore, chose not to generate electricity for export. To overcome this problem, the Energy Research Company (EPE) studied the construction of connection stations near areas where sugarcane production was expanding. However, EPE did not have solid information about the sugarcane industry to make informed decisions about connection points in order to maximize the amount of biomass electricity supplied to the Brazilian grid in the future.

Plants with a capacity of up to 30 MW paid only 50% of the fee paid for the use of transmission lines. As most of the new mills had potentially much greater capacity and the tendency was to increase further, especially with the use of sugarcane residues, this restriction should be reevaluated.

An additional question was that the energy produced by a plant was paid for on a monthly basis, regardless of how much was produced daily or hourly. It would be beneficial to allow for contracts that foresee different prices for electricity depending on the quantity produced by day and hour of the day.

The SUCRE Project therefore proposed to address the various barriers on several fronts. The first focus would be to demonstrate the technical and financial feasibility of the additional use of sugarcane residues in three mills. This would generate the technical, cost, investment and environmental information necessary to establish the sustainability and commercial viability of the proposed solutions. Once available, a disclosure effort would be made to share information with the entire sugarcane industry in Brazil and abroad. In addition, the Project would propose the replication of the solutions, supporting the analysis and planning for installation in seven other plants.

At the same time, according to the new PRODOC, information on the use of sugarcane residues to produce electricity should be made available in adequate and accessible material to facilitate contact with financial institutions such as BNDES as part of the effort to disseminate Project results.

Regulatory barriers should be addressed by the SUCRE Project through a partnership established with UNICA, an organization that supports the sugar industry in legislative and regulatory discussions with the government. The SUCRE Project, in turn, proposed to carry out an in-depth evaluation of the regulation of the electricity sector in relation to the sugarcane sector and to propose regulatory changes that would be mutually beneficial to the electricity sector and sugarcane mills.

[**2.3 Goal and Immediate Objective of the Project**](#_Toc416275487)

 **2.3.1 Goal**

The overall goal of the SUCRE Project is a significant increase in the supply to the power grid of low greenhouse gas (GHG) electricity produced in the sugarcane industry, by using the trash, produced during the harvesting of green cane, as a renewable fuel to generate electric energy.

 **2.3.2** **Immediate Objective**

The SUCRE Project’s immediate objective is to create the conditions for sugar mills to increase the export of electricity generated by sugarcane residues to the grid.

The outcomes of the SUCRE Project are designed to overcome the barriers to commercially-practiced collection and use of sugarcane residues for electricity generation and sales to the grid.

[**2.4 Baseline Indicators Established**](#_Toc416275488)

The Baseline (Business-as-usual, BAU) scenario, i.e., in the absence of implementation of this Project, is a situation common to most of the Brazilian sugarcane mill operations. In addition to bagasse, green sugarcane harvesting generates large quantities of tops and leaves, 80% of which are left on the field to decompose in the BAU scenario. About 20% of the trash is unavoidably entrained with the sugarcane stalks and ends up in the mill as part of the bagasse burned in the boilers. The 67-bar boiler pressure leads to more efficient steam generation than in the traditional 22-bar boiler systems that are still found in many of Brazil’s sugarcane mills.

The larger amount of sugarcane straw left on the field after harvest is a lost opportunity for using this biomass to generate additional electricity for export to the grid, reducing electric-sector GHG emissions. Furthermore, removal of additional trash from the fields may reduce methane generation levels, which would further reduce GHG emissions.

The baseline includes: 1) absence of a commercially accepted technology to collect, transport and use sugarcane straw for energy in mills; 2) a lack of reliable information about how to make profitable use of the available straw, which increases mill owners’ perceived risk of investing in such system; 3) a perception that electricity generation is a “minor” activity for the mills, thus receiving less attention and investment than sugar or ethanol; and 4) the difficulty of accessing financing for a “risky” technology.

According to the PRODOC, the SUCRE Project includes implementation of straw collection and its utilization to generate electricity to the grid at a minimum of three mills and support for implementation at an additional seven mills, some of which may go forward with implementation. Thus, the total GHG emissions reduction via straw recovery for electrical power and utilization would be at a minimum of three mills and a maximum of ten mills.

**Table 1: Project Strategy, Objective, Outcomes, Indicators, Baseline and Risks and Assumptions**

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| --- |
| **Project Strategy****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 electric energy (EE). |
| **Project Objective**To create the conditions for sugar mills to increase the export of electricity generated by sugarcane trash and bagasse to the grid. |
| **Objectively Verifiable Indicators**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. |
| **Outcome** | **Indicator** | **Baseline** | **Risks and Assumptions** |
| **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.- Conceptual design for trash collection system in place | **Risk:** Not getting/agreeing on the proper methodology**Assumptions:** 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;- Economic/financial performance of mills 1,2 and 3 evaluated based on actual operating data and costs. | Limited information on economic and financial viability in place, based on existing R&D- No trash electricity system available.- Electricity export from mills limited to excess energy generated with sugarcane bagasse without trash. | **Assumptions:**- Feasibility studies and business plans result in favorable economic valuation of projects **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. |
| **Outcome 3:** The effects of sugarcane 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.- Reduction of net GHG emissions associated with additional electricity generation verified based on actual operating data from mills 1,2 and 3.- Sugarcane expansion clearly demonstrated as having minimal impact on deforestation rates in Brazil.- Additional removal of trash for electricity generation demonstrated no has negligible detrimental impact on soil. | - No guidelines required as no trash system is in use.- No GHG reductions because no trash system in place.- Studies conducted to date do not link sugar sector to increased deforestation.- Historical data suggests that additional trash removal does not impact soil quality. | **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.**Risks:**- Not getting the proper information.**Assumptions:**- Trash system is implanted and operated successfully.- Required information is available on time.**Risks:**- Assessment reveals more impact on deforestation than currently assumed.**Assumptions:**- Full information is available to conduct assessment.**Risks:**- Assessment reveals more impact on soil quality than currently assumed.**Assumptions:**- Full information is available to conduct assessment. |
| **Outcome 4:** Sugarcane trash is being utilized across the sugarcane sector with private investment taking benefit from lessons learned. | - Guidelines issued for general pre-feasibility assessment in sugarcane.- Feasibility studies and basic engineering of 7 mills (beyond the first three) interested in installing the trash system completed.- Sale of additional 120.000 MWh/yr (from mills #2 and #3) after 5 years.Mill #4 invests in electricity generation with bagasse.- Expression of interest (contracted studies, letters of interest, participation at seminars, phone inquiries, et.) from companies in trash electricity, indicating market transformation. | - No existing guidelines or procedures in place.- No feasibility studies being made.- No trash system installed.- Mill #4 not yet committed to project implementation. No trash system in place in additional mills.- No investors interested. | **Assumptions:**Knowledge generated through implementation in 3 mills is sufficient to generate guidelines.**Risks:**- Not getting the proper information.**Assumptions:**- Trash system is implanted and operated successfully.- Required information is available on time.**Risks:**- Not having the trash system available for installation.- Not getting the required permission.- Not solving the legal and institutional issues.**Assumptions:**- Financial support available.- Suppliers deliver on time.- Team in place on schedule.**Risks:**- Investment in first three mills does not clearly demonstrate the economic benefits of investment in generation with sugarcane trash.**Assumptions:**- Sugarcane sector remains financially healthy and is not adversely affected by external economic crisis.**Risks:**- Quality of information dissemination is inadequate to gain interest of stakeholders.**Assumptions:**- Information dissemination system are effective. |
| **Outcome 5:** An adequate legal and regulatory framework is in place to promote the sustainable use of sugarcane 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. | **Risks:**- Not getting the proper information.**Assumptions:**- Required information is available on time. |
| **Outcome 6:** Project monitoring, learning, adaptive feedback and evaluation. | - Internal monitoring is applied and adaptive feedback mechanisms are implemented.- High quality external evaluations are conducted. | - Internal monitoring procedure described in project document.- Project document reflects current understanding of best project strategy.- No evaluations conducted. | **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.**N/A** |

Source: Substantive Revision 1 (new PRODOC), signed April 20, 2015.

**2.5 Main stakeholders**

The partnerships established by the SUCRE Project were the result of the process of interaction and engagement with the sugar and alcohol industries, aiming at achieving the objectives of the Project with the development of its activities to obtain the expected results. In addition, stakeholders were identified during implementation of the Project, including government institutions, associations, experts on the generation of renewable energy from sugarcane biomass, equipment manufacturers, universities, research institutions, among others. The establishment of partnerships with the main stakeholders promoted experimentation and application of innovative technologies, generating new knowledge and information. This far-reaching context enabled the efficient performance of the proposed activities and has been important for consolidation of the partnerships.

It can be seen that the experience of electric energy generation through processing of sugarcane straw aggregated to bagasse and the strengthening of the sale of this energy in the national electric system were made possible by the lessons learned from other related projects and the convergence among the technical and financial contributions provided by GEF/UNDP and counterpart support provided by the partnerships established with sugarcane and other industries, in addition to the Brazilian government, such as MCTIC.

CTBE, the executing agency of the SUCRE Project, linked to the National Center for Research on Energy and Materials (CNPEM), are the main stakeholders of the Project. In item 3 of this report, other stakeholders are analyzed.

**2.6 Expected Results**

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| **SUCRE Project** |
| **Outcomes:** | **Outputs:** | **Activities:** |
| 1. Technology for sugarcane trash collection and conversion for electricity generation has been made operational for commercial use. | 1.1. Process and equipment engineering for collection of sugarcane trash. | 1.1.1. Mineral and vegetal impurity composition and characterization of both bagasse and trash from different soil types and seasonality. |
| 1.1.2. Design of two alternatives of pilot equipment for dry clean (rotating screen and air cyclone. |
| 1.1.3. Design and fabrication of pilot burning system comprised of burner/combustion chamber/fan to evaluate combustion gas composition. |
| 1.1.4 Determination of ash and gas composition from burnt bagasse, trash and their mix in different proportions. |
| 1.1.5. Fine tune/optimize harvesting, collecting and transporting of trash. |
| 1.1.6 Evaluate harvesting performance.1.1.7 Fine tune/optimize separation, cleaning, storing, chopping and feed of trash |
| 1.2. Determination of the merits and constraints of technical solutions for trash collection and utilization. | 1.2.1. Evaluation of data from output 1.1 |
| 1.2.2. Technical, economic and environmental analysis of two alternatives of pilot equipment for dry clean (rotating screen and air cyclone) |
| 1.3. Installation and operation of (at least) one technical solution for trash sugarcane trash collection and utilization for electricity generation. | 1.3.1. Installation and commissioning of pilot equipment for bagasse/trash cleaning at CTBE’s PPDP. |
| 1.3.2. Define trash recovery strategy, harvesting equipment specification, harvesting equipment configuration and quantity of each equipment for mill #1 |
| 1.3.3. Basic implementation project for mill #1 |
| 1.3.4. Follow up of trash system plant construction for mill #1 |
| 1.4. Technical and process optimization of installed trash collection and processing systems. | 1.4.1 Experimental planning design for process and equipment optimization for maximum clean efficiency. |
| 1.4.2. Technical evaluation and economic and environmental assessment of the proposed technologies (now implemented, using measured operation data) |
| 1.4.3. System performance evaluation.1.4.4. Definition of system modifications1.4.5. Modification of trash system1.4.6. Implement engineering improvements or suggest them to manufactures of equipment showing the market potential – improvement chain. |
| 2. The economic viability of sugarcane trash collection and utilization for electricity generation is demonstrated in commercial sugar mills. | 2.1. Economic analysis of applicable trash collection and processing system in sugar mills | 2.1.1. Establishment of an applicable methodology for economic and environmental evaluation of trash collection and processing systems in sugar mills. |
| 2.2. Evaluation of electricity generation scenarios based on combined bagasse/trash utilization by commercial mills. | 2.2.1. Assessment of electricity generation scenarios based on combined bagasse/trash utilization by commercial sugar mills. |
| 2.3. Completed feasibility studies for sugarcane trash collection and processing investments in first batch (initially 3) of sugar mills. | 2.3.1. Technical, economic and environmental feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in first batch (envisaged: 3) of sugar mills. |
| 2.4. Expert assistance to support business development and PPA contracting by first batch of sugar mills. | 2.4.1. Support mills on the definition of energy sale price. |
| 2.4.2. Support mills on the analysis of sale alternatives.2.4.3. Technical support to mills on EE sale contract analysis. |
| 2.5. Monitoring of technical, economic, and environmental performance of installed trash utilization systems in first batch of sugar mills. | 2.5.1. Monitoring technical, economic and environmental parameters for feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in first batch of sugar mills. |
| 3. The effects of sugarcane trash collection on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long-term sustainability. | 3.1. Integral assessment of the impacts of trash removal on the sugarcane production system, including soil quality, water usage, sugarcane yields, weeds, pests and diseases, etc, | 3.1.1. Impacts of trash removal on soil chemical, physical and biological attributes. |
| 3.1.2. Impacts of trash removal on greenhouse gas emissions and soil carbon sequestration. |
| 3.1.3. Impacts of trash removal on soil water retention, soil cover, soil erosion and sediment loses |
| 3.1.4. Impacts of trash removal on pests and diseases infestation |
| 3.1.5. Impacts of trash removal on weed population |
| 3.1.6. Impacts of trash removal on sugarcane yield and quality |
| 3.1.7. Monitoring field experiments to incorporate field experiment results in the technical, economic, and environmental assessments of the impacts of trash removal on the sugarcane production system. |
| 3.2. Expert assistance to support environmental permitting for first batch of sugar mills | 3.2.1 Support the preparation of the studies required to get the environmental permits for mill #1, #2 and #3 |
| 3.2.2. Support the preparation of the studies required to get the environmental permits for mill #1 #2 and #3 by means of technical, economic, and environmental assessments |
| 3.3. Guidelines for environmentally acceptable implementation of trash utilization (collecting/processing) | 3.3.1. Evaluation of preventive and corrective measures related with the trash use |
| 3.3.2. Definition the basic parameters for monitoring trash system |
| 3.3.3. Preparation of guidelines 3.3.4. Assistance to guidelines preparation with recommendations for environmentally acceptable implementation of trash utilization (collecting/processing) by means of technical, economic, and environmental assessments. |
| 4. Sugarcane trash is being utilized across the sugarcane sector with private investment taking benefit from lessons learned. | 4.1. A template has been developed for the appraisal of trash utilization projects by the sugarcane sector. | 4.1.1. Definition of methodology / criteria |
| 4.1.2. Development of a template for the appraisal of trash utilization projects by the sugarcane sector. |
| 4.1.3. Dissemination of guidelines |
| 4.2 Trash utilization systems for electricity production have been installed in first batch of sugar mills (initially 3) | 4.2.1 Estimate trash availability and amount of trash to be recovered for mills #1, #2 and #3 |
| 4.2.2 Trash recovery strategy, harvesting equipment specification, harvesting equipment configuration and quality of each equipment for mills #2 and #3 |
| 4.2.3 Basic implementation project for mills #2 and #3 |
| 4.2.4 Follow up of trash system plant construction for mills #2 and #3; erection and commissioning |
| 4.3. Expert support has been provided to carry out feasibility studies for trash utilization systems in second batch of sugar mills (initially 7). | 4.3.1. Selection of sugarcane mills  |
| 4.3.2. Technical, economic and environmental feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in second batch ( envisagedly: 7) of sugar mills. |
| 4.4 Investment for second batch of sugar mills has been leveraged | 4.4.1Select sugar mail on basis of financial commitment to project  |
| 4.5. Development of a database structure to support the implementation and dissemination of the project | 4.5.1. Database structure |
| 4.5.2. Development of a webgis tool to dissemination |
| 4.5.3. Development of a blog as information tool |
| 4.6. Remote sensing as a tool to implement the system in mills | 4.6.1. Sugarcane maps |
| 4.6.2 Straw estimation using satellite data |
| 5. An adequate legal and regulatory framework is in place to promote the sustainable use of sugarcane trash for electricity generation and sales to the grid. | 5.1. Updated study of regulatory barriers and opportunities related with the participation in the electricity market | 5.1.1. Study of the electrical sector legislation and EE sales contracts |
| 5.1.2. Study of regulatory opportunities and barriers, identifying options to overcome the identified barriers |
| 5.1.3 Technical support to institutional studies (aiming on overcoming barriers)  |
| 5.2. Analytical support to sugarcane sector stakeholders regarding institutional, regulatory, and legal aspects of electricity generation. | 5.2.1. Provide legal/regulatory advice to sugarcane industry investors regarding electricity sales to grid. |
| 5.2.2. Provide legal/regulatory advice to relevant stakeholders regarding contracting for trash supply.  |
| 5.3. Regulatory changes to support trash utilization for electricity generation are promoted for formal approval. | 5.3.1. Analyze potential impact of alternative regulatory changes on industry-wide trash-to-electricity generation |
| 5.3.2. Interact with government in pursuit of regulatory changes that would facilitate greater trash-to-electricity implementation. |
| 6 Project monitoring, learning, adaptive feedback, and evaluation | 6.1. Project monitoring and results evaluation | 6.1.1. Conduct project internal monitoring  |
| 6.1.2 Conduct Mid Term and Final Evaluations  |
| 6.2. Lessons learning and adaptive feedback | 6.2.1 Adjust project strategy according to feedback obtained during project implementation6.2.2. Contribute to the preparation of lessons learned and adaptive feedback |
| 7 Project management | 7.1 Project management | 7.1.1 Project management |

According to the Substantive Revision, the new PRODOC, which was adjusted to include new dates, the project outcomes and outputs are stated below:

**Outcome #1: Technology for sugarcane trash collection and conversion for electricity generation has been made operational for commercial use.**

***Output #1.1 Process and equipment engineering for collection of sugarcane trash.***

This output intends to establish partnerships with participating mills, to define the trash recovery technology route for each mill, to conduct a first evaluation (technical analysis and trials) to establish the baseline, making it possible to define needs for redesign.

***Output #1.2 Determination of the merits and constraints of technical solutions for trash collection and utilization.***

This output seeks to develop activities related to:

* establish trash recovery and transport operations (process, equipment and performance);
* establish the baseline of the industry sugarcane processing (process, equipment, and performance);
* determine the sugarcane harvesting and transport conditions considering trash recovery;
* determine trash field collection and transport operational conditions;
* determine the impact on sugarcane processing considering trash recovery (quantify performance, maintenance and other impacts of benefits and harms);
* determine trash industry processing operational conditions/parameters; and
* new equipment specifications and detailed design of the necessary modifications.

***Output #1.3 Installation and operation of (at least) one technical solution for sugarcane trash collection and utilization for electricity generation.***

This output seeks to develop the further activities:

* at least one mill with trash recovery and use system installed and operational (field and industry); and
* at least one mill exporting 60.000 MWh/year to the grid;

***Output #1.4 Technical and process optimization of installed trash collection and processing system.***

This output seeks to carry out further activities:

* Optimization needs identified for at least 1 mill (based on field and factory trials;
* design modifications carried out;
* modifications implemented and trials confirm improvements; and
* partnerships, disseminations and licensing conducted to assure commercial replication.

**Outcome #2: The economic viability of sugarcane trash collection and utilization for electricity generation is demonstrated in commercial sugarcane.**

***Output #2.1 Economic analysis of applicable trash collection and processing system in sugar mills.***

This output seeks to develop the further activity:

* establishment of an applicable methodology for economic and environmental evaluation of trash collection and processing systems in sugar mills.

***Output #2.2 Evaluation of electricity generation scenarios based on combined bagasse/trash utilization by commercial sugar mills.***

This output seeks to develop the further activity:

* assessment of electricity generation scenarios based on combined bagasse/trash utilization by commercial sugar mills.

***Output #2.3 Completed feasibility studies for sugarcane trash collection and processing investments in first batch (initially 3) of sugar mills.***

This output seeks to develop the further activity:

* technical, economic and environmental feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in first batch (envisaged: 3) of sugar mills.

***Output #2.4 Expert assistance to support business development and PPA contracting by first batch of sugar mills.***

This output seeks to develop the further activities:

* support mills on the definition of energy sale price;
* support mills on the analysis of sale alternatives; and
* technical support to mills on EE sale contract analysis.

***Output #2.5 Monitoring of technical, economic and environmental performance of installed trash utilization systems in first batch of sugar mills.***

This output seeks to develop the further activity:

* monitoring technical, economic and environmental parameters for feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in first batch of sugar mills.

**Outcome #3: The effects of sugarcane trash collection on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long**-**term sustainability.**

***Output #3.1 Integral assessment of the impacts of trash removal on the sugarcane production system, including soil quality, water usage, sugarcane yields, weeds, pests and diseases, etc..***

This output seeks to develop the further activities:

* impacts of trash removal on soil chemical, physical and biological attribute;
* impacts of trash removal on greenhouse gas emissions and soil carbo sequestration;
* impacts of trash removal on soil water retention, soil cover, soil erosion and sediment loses;
* impact of trash removal on pests and diseases infestation;
* impact of trash removal on weed population;
* impact of trash removal on sugarcane yield and quality; and
* monitoring fields experiments to incorporate field experiment results in the technical, economic and environmental assessments of the impacts of trash removal on the sugarcane production system.

 ***Output #3.2 Expert assistance to support environmental permitting for first batch of sugar mills.***

This output seeks to develop the further activities:

* support the preparation of the studies required to get the environmental permits for mill #1, #2 and #3; and
* support the preparation of the studies required to get the environmental permits for mill #1, #2 and #3 by means of technical, economic and environmental assessments.

***Output #3.3 Guidelines for environmentally acceptable implementation of trash utilization (collecting/processing).***

This output seeks to develop the further activities:

* evolution of preventive and corrective measures related with the trash use;
* definition of basic parameters for monitoring trash system;
* preparation of guidelines; and
* assistance to guidelines preparation with recommendations for environmentally acceptable implementation of trash utilization (collecting/processing) by means of technical, economic, and environmental assessments.

**Outcome # 4: Sugarcane trash is being utilized across the sugarcane sector with private investment taking benefit from lessons learned.**

***Output #4.1 A template has been developed for the appraisal of trash utilization projects by the sugarcane sector.***

This output seeks to develop the further activities:

* definition of methodology/criteria;
* development of a template for the appraisal of trash utilization projects by the sugarcane sector; and
* dissemination of guidelines.

***Output #4.2 Trash utilization system for electricity production have been installed in first batch of sugar mills (initially3).***

This output seeks to develop the further activities:

* estimate trash availability and amount of trash to be recovered for mill #1, #2 and #3;
* trash recovery strategy, harvesting equipment specification, harvesting equipment configuration and quality of each equipment for mills #2 and #3;
* basic implementation project for mills #2 and #3; and
* follow up of trash system plant construction for mills #2 and #3; erection and commissioning.

***Output #4.3 Expert support has been provided to carry out feasibility studies for trash utilization systems in second batch of sugar mills (initially 7).***

This output seeks to develop the further activities:

* selection of sugarcane mills; and
* technical, economic and environmental feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in second batch (envisaged: 7) of sugar mills.

***Output #4.4 Investment for second batch of sugar mills has been leveraged.***

This output seeks to develop the further activity:

* select sugar mill on the basis of financial commitment to project.

***Output #4.5 Development of a database structure to support the implementation and dissemination of the project.***

This output seeks to develop the further activities:

* database structure;
* development of a webGIS tool to dissemination; and
* development of a blog as information tool.

***Output #4.6 Remote sensing as a tool to implement the system in mills.***

This output seeks to develop the further activities:

* sugarcane Maps; and
* straw estimation using satellite data.

**Outcome #5: An adequate legal and regulatory framework is in place to promote the sustainable use of sugarcane trash for electricity generation and sales to the grid.**

***Output #5.1 Updated study of regulatory barriers and opportunities related with the participation in the electricity market.***

This output seeks to develop the further activity:

* study of the electrical sector legislation and EE sales contracts.

***Output #5.2 Analytical support to sugarcane sector stakeholders regarding institutional, regulatory, and legal aspects of electricity generation.***

This output seeks to develop the further activities:

* study of regulatory opportunities and barriers, identifying options to overcome the identified barriers;
* technical support to institutional studies (aiming on overcoming barriers);
* provide legal/regulatory advice to sugarcane industry investors regarding electricity sales to grid; and
* Provide legal/regulatory advice to relevant stakeholders regarding contracting for trash supply.

***Output #5.3 Regulatory changes to support trash utilization for electricity generation are promoted for formal approval.***

This output seeks to develop the further activities:

* analyze potential impact of alternative regulatory changes on industry-wide trash-to-electricity generation; and
* interact with government in pursuit of regulatory changes that would facilitate greater trash-to-electricity implementation.

**Outcome # 6: Project monitoring, learning, adaptive feedback and evaluation.**

***Output #6.1 Project monitoring and results evaluation.***

This output seeks to develop the further activities:

* conduct project internal monitoring; and
* conduct Midterm and Final Evaluations.

***Output #6.2 Lessons learned and adaptive feedback.***

This output seeks to develop the further activities:

* adjust project strategy according to feedback obtained during project implementation; and
* contribute to the preparation of lessons learned and adaptive feedback.

**Outcome #7: Project management**

***Output #7.1 Project management.***

This output seeks to develop the further activity:

* project management.

[**3 Findings**](#_Toc416275489)

**3.1 Project Strategy**

 **3.1.1 Project Design**

Formulation of the SUCRE Project was based on results of the previous project on “Biomass Power Generation” executed by the CTC and supported by GEF dealing with the use of sugarcane biomass for energy generation. After completion, the CTC received an indication that the GEF could consider supporting a new project to commercialize its technical solutions.

The new project proposal sought to continue developing more promising solutions for the collection, transportation and cleaning of sugarcane straw and other residues that could be added to bagasse for electric power generation. This approach, besides showing CTC’s commitment to the idea of ​​transforming “waste” into a new fuel, would also reduce risks, financing difficulties and the time needed to implement the SUCRE Project proposal. However, CTC was no longer eligible to be the new executing agency and execution became the responsibility of CTBE/CNPEM.

The SUCRE Project considered the need to seek suitable technologies for the collection, washing and baling of waste, transportation and processing in sugarcane mills. In addition, it also had the objective of supporting the sale of power generated in the Brazilian grid, following the rules and regulations of the electricity sector. Thus, the design provided for identification of appropriate technologies through field experiments, technical support to the partner mills and dissemination of results at the local, national and international levels.

The design of the SUCRE Project considered including in its results the following topics:

* Technological barriers in the field and the industry and act to overcome them;
* Economic feasibility of using sugarcane residues in order to seek financing;
* Impacts of removal of sugarcane residues on the crop cycle in order to guarantee environmental and social integrity;
* Barriers of lack of techno-economic and environmental information;
* Monitoring and evaluation requirements of the technical process and administrative procedures, as well as efficient management of activities.

The SUCRE Project demonstrated its relevance since it recognizes the importance of biomass in the transition to a world of low GHG emissions and demand for electric power in the field and in industry. Furthermore, the project is relevant because the burning of sugarcane biomass for the production of electricity is clean or renewable green energy, without environmental impacts like the burning of fossil fuels. The success of the project can also catalyze technological innovation efforts in Brazil and other countries.

The MTR concludes that the SUCRE Project was formulated considering the execution of activities aimed at obtaining results that are interrelated, seeking to achieve objectives of: a) establishing a commercial electricity supply market based on sugarcane for the Brazilian electricity grid; and b) creating technological conditions to increase and improve the export of electricity generated by sugarcane mills from the processing of residues to the Brazilian electricity grid.

The activities were defined considering technical, economic, financial, environmental, legal and regulatory aspects, as well as those related to replication and monitoring and management.

The project involves partnerships with sugarcane mills that establish technical cooperation agreements with CTBE. The first phase of the Project involved four pre-selected plants and the second phase included another seven sugarcane plants.

The establishment of partnerships for the achievement of the objectives and activities of the Project thus reflects the efficiency and sustainability of actions and the achievement of targets for reducing greenhouse gas emissions.

Therefore, the Project components were defined according to the proposed objectives and activities to be developed, contributing to the achievement of the desired and explicit results in the project document, signed on April 20, 2015, by the Brazilian Government and UNDP.

The Project was prepared specifying the activities to be carried out over a five-year period, with completion scheduled for December 2019. The final end date may be revised by a Substantive Review to be requested and submitted for approval by the Brazilian Cooperation Agency (ABC), GEF and UNDP.

 **3.1.2 Results Framework/Log frame**

**Table 2: Progress Towards Results Matrix (Achievement of outcomes against End-of-project Targets, since there were no Midterm Targets)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Project Strategy** | **Indicator28** | **Baseline Level29** | **Level in 1st PIR (self- reported)** | **Midterm Target30** | **End-of- project Target** | **Midterm Level & Assess-ment31** | **Achieve-ment Rating32** | **Justification for Rating** |
| Objective: | Trash system implemented and operating. | No mills or distilleries are using the trash produced by the green harvesting. | 2016Highly Satisfactory |  |  |  |  |  |
| Outcome 1: | Indicator 1: Trash collection system design finalized and operational.  Indicator 2: Sale of additional 60,000 MWh/yr of electricity (from mill #1) after three years. | No methodology to define trash to be collected in place.No trash system installed. | Highly SatisfactoryHighly Satisfactory | Trash collection, processing and burning system are operational.in Batch 1. Technical challenges in straw collection, processing and burning were linked to mineral impurities and other pollutants, impairing equipment performance and increasing the maintenance costs. Alternative technical solutions are being tested. | Methodology defined and being used. Final design implemented and operational in mill #1. Generation of electricity from trash at mill #1. | 2018Highly Satisfactory | Highly satisfactory | Technology has been made operational for commercial use. |
|  |  |  |
| Outcome 2: | - Economic feasibility is fully assessed prior to investment. Economic/financial performance of mills #1, #2, and #3 evaluated based on actual operating data and costs.  | Limited information on economic and financial viability in place, based on existing R&D No trash-electricity system available  | Highly Satisfactory |  Sucre team worked during 1st semester of 2018 in the adjustment of parameters to reflect realistic ranges of operate conditions to econ. assessment. The adjustment will allow achieving more reliable results for all the mills assessed, Batch 1 or 2. Other fact for economic feasibility assessment is the indirect costs. Increases in transportation, maintenance costs of the sugarcane straw insertion in the electricity production are being quantified and incorporated in the simulation models to better results. Economic feasibility is linked to electricity sale prices, which present great levels of variation. Simulations of economic feasibility give to the partner mill the minimum price above which they can operate profitably, based in the production costs of expanding electricity production.  | Full feasibility studies and business plans finalized for mills 1, 2, 3 Economic feasibility demonstrated for use of trash for exportable electricity at mills #1,2,3 | 2018Highly Satisfactory | Highly Satisfactory | Economic feasibility for commercial use of sugarcane energy has been demonstrated. |
|  |  |
|  |  |
| Outcome 3: | -Guidelines for environmentally acceptable trash utilization completed and distributed. Reduction of net GHG emissions associated with additional electricity generation verified based on actual operating data from mills #1, #2, and #3. Sugarcane expansion clearly demonstrated as having minimal impact on deforestation rates in Brazil. Additional removal of trash for electricity generation demonstrated to have negligible detrimental impact on soil.  | No guidelines required as no trash system is in use. No GHG reductions because no trash system in place. Studies conducted to date do not link sugar sector to increased deforestation. Historical data suggests that additional trash removal does not impact soil quality.  | Highly Satisfactory | In general, results showed that sugarcane expansion occurred over previously deforested areas, not contributing to the recent deforestation of Cerrado and Atlantic Forest Biomes. Other output is the Sugarcane straw removal zoning project, which consists in a map that shows suitability of Brazilian Center-South regions to sugarcane straw removal. The map is based on climatic conditions, from more than 3000 monitoring points, that drivers mulching effects on sugarcane productivity. Together with the map, Sucre team will release specific guidelines to quantify straw removal, which will be based on onsite conditions as soil texture, harvest season, and others. The map with macro-zones of suitability for sugarcane straw removal will be finished in 2018.  | Guidelines completed and in use. Quantitative understanding of potential net GHG reductions from use of trash for electricity generation. Sector wide analysis of CDM potential for enhanced trash use.  | 2018Highly Satisfactory | Highly Satisfactory | Effects on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long-term sustainability. |
| Outcome 4: | Guidelines issued for general pre -feasibility assessment in sugar mills. Feasibility studies and basic engineering of 7 mills (beyond the first three) interested in installing the trash system completed. Sale of additional 120,000 MWh/yr (from mills #2, and #3) after five years. Expressions of interest (contracted studies, letters of interest, participation at seminars, phone inquiries, etc.) from companies in trash-electricity, indicating market transformation | No existing guidelines or procedures in place. No pre-feasibility studies being made. No trash system installed. No trash system in place in additional mills. No investors interested.  | Highly Satisfactory | Integrated assessment is being refined for mill #1, exploring another recovery options based on the mill choices. Integrated assessment for mills #2 and #3 will be finished until December 2018. The mills from Batch 2 are defined and engaged to the Project. Methodology for the evaluation of those partners was defined and will be discussed in two meetings with the PAC and other with the partner mills. Project results are gaining the interest from important groups (Raízen, Tereos and São Martinho). Until the end of the project, it will be released a website tool that will summarize all the Project results, which will allow the users to obtain general outputs.  | Clear streamlined guidelines and procedures for assessing potential benefits of additional generation with sugarcane trash. Guidelines for general pre-feasibility assessment of trash utilization. - Feasibility studies for 7 mills (beyond the first three) completed. Generation of electricity from trash at mill #2 and #3. Clear demonstration of interest by 7 additional mills in investing in additional electricity generation with trash.  | 2018Highly Satisfactory | Highly Satisfactory | Sugarcane trash is being utilized across the sugarcane sector with private investment taking benefit from lessons learned. |
| Outcome 5: | 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.  | Highly Satisfactory | The material to support mills in decisions on trash based electricity production and commercialization was released. Workshops and meetings with representatives of the mills and other sucro-energetic sector associations were made to discuss and to consolidate suggestions to improve regulatory and legal framework.  | Full knowledge of relevant legislation regulating the electricity sector in Brazil is obtained, including potential solutions to address remaining barriers for generation with trash. Meetings conducted with relevant state entities to discuss new regulatory framework that addresses sugarcane industry trash-to-electricity issues and barriers.  | 2018Highly Satisfactory | Highly Satisfactory | An adequate legal and regulatory framework is not yet in place to promote the sustainable use of sugarcane trash for electricity generation and sales to the grid. |
| Outcome 6: | Internal monitoring is applied and adaptive feedback mechanism are implemented | Internal monitoring procedure described in project document.Project document reflects current understanding of best project strategy. | Highly Satisfactory |  |  | 2018Highly Satisfactory. | Highly Satisfactory. | Project monitoring, learning, adaptive feedback and evaluation are being carried out. |

**Source: *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects.* Indicator Assessment Key**

|  |  |  |
| --- | --- | --- |
| Green= Achieved | Yellow= On target to be achieved | Red= Not on target to be achieved |

In this analysis, there are no areas marked as “Not on target to be achieved”.

The Results and Resources Matrix, the Annual Work Plan and the Management Arrangements make up the Project Logical Framework focused on achieving the objectives. The Project formulation includes arrangements for the development of management and monitoring and evaluation activities and means to monitor the execution of the financial budget.

The rationale in the PRODOC is that the actions of identifying and testing technologies, training, technological strengthening of sugarcane mills and companies with adequately installed laboratories and qualified professionals contribute to the impact of the Project's activities.

According to the MTR, in the specific case of the SUCRE Project, these factors have favored obtaining results and preparatory products towards the general objective of export and commercialization of biomass electricity for the national electricity grid, contributing to the reduction of emissions of greenhouse gases.

Also, according to the MTR evaluator, the formulation of the SUCRE Project (BRA/10/G31) and its procedures to achieve effective results have provided conditions for discussion about the importance and relevance of implementing its objectives and actions with the partners and stakeholders involved in the sector and to achieve the proposed results according to specific, measurable, achievable, relevant and time-bound (SMART) indicators.

In this sense, the log frame presents elements to monitor the implementation and, simultaneously, the dissemination of information that may contribute to national and global environmental awareness about the importance of protecting the environment with reduction of GHG emissions.

The logical framework provided a plan for the project structure, establishing forms of intervention, procedures and work methods, organized in order to lead to the most complex executive elements to the most specific and necessary elements for data collection, processing and analysis actions for innovative technology processes for the purpose of marketing clean and renewable energy.

The objectives and indicators of the logical structure function so as to print out problems to be faced. According to the MTR, the analysis of the project structure shows that these elements are clear and feasible to achieve the Project’s outputs and results. In addition, the indicators have allowed the periodic monitoring of actions in relation to the established baselines.

**3.2 Progress Towards Results**

 **3.2.1 Progress Towards Outcomes analysis**

According to the analysis of log frame indicators in the section above, there has been good progress toward achieving all outcomes, which are on target for being achieved at the end of the project. The project design in the fourth operational phase of GEF did not include tracking tools.

The products and results of the SUCRE Project components involved, as already mentioned, experimental, laboratory and theoretical research activities to build a knowledge base to be passed on critically to partners and stakeholders involved in the objectives of this Project, as indicated in Table 6, Results/Activities, that lists the activities carried out, the products obtained in relation to the goals and the inputs required.

This section evaluates the activities involved in the preparation of products for each year of execution. The main objectives of the achievement of the products described here are related to the results established by the Project and oriented to its general objective, which is to catalyze sugarcane energy generation actions to create a solid market for the sale of renewable electric energy to the grid, which has been carried out by the effective and participatory action of the CTBE/CNPEM team in close interaction with Project partners.

The information contained in this MTR Report is based on the activity execution reports provided by the CTBE/UNDP team and contained in the Project Implementation Reviews (PIR) as well as the Annual Work Plan (AWP) and financial performance reports, as well as data and information from projects already carried out by UNDP and other institutions such as the BRA/96/G31 project, “Biomass Power Generation: Sugarcane Bagasse & Trash” and other information obtained from interviews conducted during the MTR process.

Among the results achieved due to the Project, the generation and export of electricity to the grid by the 4 plants of Batch 1 are as follows:

**Table 3: generation and export of electricity to the grid**

**by the 4 plants of Batch 1**

|  |  |  |
| --- | --- | --- |
| **Partner Mills (Batch 1)** | **Electricity (MWh/year)** | **Milling Capacity (Mt/year)** |
| Quata | 87,600.00 | 3 |
| Alta Mogiana | 200,565.00 | 6.5 |
| Pedra | 337,105.00 | 4.5 |
| Barra | 259,571.00 | 7.7 |
| **Total** | **884,841.00** | **21.7** |

Data included in the first qualitative SUCRE report for the MTR presented to the Evaluator from the Batch 1 mills were supplied by the partners themselves to the SUCRE Project team.

In the Substantive Review of 2015, the indicator refers export of 180,000 MWh per year from the 3 Batch 1 plants, with an average capacity of 2 million tons of processed cane per year. The implementation of SUCRE was carried out with 4 partners, not 3, and thus, following the same rule of generation, export and milling capacity, the four partners would have to export 651 thousand MWh/year to the grid, since the added milling capacity of the fourth mill is 21.7 million tons of sugarcane per year. The 4 partners are generating and exporting to the network about 36% more than what is foreseen as a target in the Project.

The second report shows economic viability for the Batch 1 partners who provided information, and the third shows an estimate of GHG emissions mitigation by each of the Batch 2 partners, considering the electricity produced from biomass compared to natural gas applying the life-cycle assessment methodology.

The products and the partial implementation results of the SUCRE Project were considered by the Evaluator to be highly satisfactory (HS), in relation to the objectives and activities, as presented in Table 4.

**Table 4: Partial Results regarding to Project Objectives and Activities**

| **Goal:** The overall goal of the SUCRE Project is a significant increase in the supply to the grid of low greenhouse gas (GHG) electricity produced in the sugarcane industry by using the trash, produced during the harvesting of green cane, as a renewable fuel to generate EE.**Objective:** The SUCRE Project general objective is to create the conditions for sugar mills to increase the export of electricity generated by sugarcane trash and bagasse to the grid.**Outcomes purpose:** The Project outcomes are designed to overcome the barriers to commercially-practiced collection and utilization of sugarcane trash for electricity generation and sales to the grid. |
| --- |
| **Output Description** | **Activities carried out and Outputs achieved/year 2015-2016** | **Activities carried out and Outputs achieved/year 2016-2017** | **Activities carried out and Outputs achieved/year 2017-2018** |
| **Outcome 1: Technology for sugarcane trash collection and conversion for electricity generation has been made operational for commercial use.** |
| **Activities/Year** | **2015-2016** | **2016-2017** | **2017-2018** |
| **Outcome #1: Technology for sugarcane trash collection and conversion for electricity generation has been made operational for commercial use.** ***Output #1.1Process and equipment engineering for collection of sugarcane trash.***This output intends to establish partnership with participating mills, to define trash recovery technology route for each mill, to conduct a first evaluation (technical analysis and trials) to establish the baseline, making possible to define redesign needs. ***Output #1.2 Determination of the merits and constraints of technical solutions for trash collection and utilization.***This output seeks to develop activities relate to: * establish trash recovery and transport operations (process, equipment and performance);
* establish the baseline of the industry sugarcane processing (process, equipment and performance);
* determine the sugarcane harvesting and transport conditions considering trash recovery;
* determine trash field collection and transport operational conditions;
* determine the impact on sugarcane processing considering trash recovery (quantify performance, maintenance and other impacts of benefits and harm);
* determine trash industry processing operational conditions/parameters; and
* new equipment specifications and detailed design of the necessary modifications.

 ***Output #1.3 Installation and operation of (at least) one technical solution for sugarcane trash collection and utilization for electricity generation.***This output seeks to develop further activities:* at least one mill with trash recovery and use system installed and operational (field and industry); and
* at least one mill exporting 60.000 MWh/year to the grid;

 ***Output #1.4 Technical and process optimization of installed trash collection and processing system.***This output seeks to develop further activities:* optimization needs identified for at least 1 mill (based on field and factory trials;
* design modifications carried out;
* modifications implemented and trials confirm improvements; and
* partnerships, disseminations and licensing conducted to assure commercial replication.

**Outcome #2: The economic viability of sugarcane trash collection and utilization for electricity generation is demonstrated in commercial sugar mills.** ***Output #2.1 Economic analysis of applicable trash collection and processing system in sugar mills.***This output seeks to develop the further activity:* establishment of an applicable methodology for economic and environmental evaluation of trash collection and processing systems in sugar mills.

 ***Output #2.2 Evaluation of electricity generation scenarios based on combined bagasse/trash utilization by commercial sugar mills.***This output seeks to develop the further activity:* assessment of electricity generation scenarios based on combined bagasse/trash utilization by commercial sugar mills.

 ***Output #2.3 Completed feasibility studies for sugarcane trash collection and processing investments in first batch of (initially 3) sugar mills.***This output seeks to develop the further activity:* technical, economic and environmental feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in first batch (envisaged: 3) of sugar mills.

 ***Output #2.4 Expert assistance to support business development and PPA contracting by first batch of sugar mills.***This output seeks to develop the further activities:* support mills on the definition of energy sale price;
* support mills on the analysis of sale alternatives; and
* technical support to mills on EE sale contract analysis.

 ***Output #2.5 Monitoring of technical, economic and environmental performance of installed trash utilization systems in first batch of sugar mills.***This output seeks to develop the further activity:* monitoring technical, economic and environmental parameters for feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in first batch of sugar mills.

**Outcome #3: The effects of sugarcane trash collection on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long**-**term sustainability.** ***Output #3.1 Integral assessment of the impacts of trash removal on the sugarcane production system, including soil quality, water usage, sugarcane yields, weeds, pests and diseases, etc..***This output seeks to develop further activities:* impacts of trash removal on soil chemical, physical and biological properties;
* impacts of trash removal on greenhouse gas emissions and soil carbon sequestration;
* impacts of trash removal on soil water retention, soil cover, soil erosion and sediment losses;
* impact of trash removal on pest and disease infestation;
* impact of trash removal on weed population;
* impact of trash removal on sugarcane yield and quality; and
* monitoring fields experiments to incorporate field experiment results in the technical, economic and environmental assessments of the impacts of trash removal on the sugarcane production system.

 ***Output #3.2 Expert assistance to support environmental permitting for first batch of sugar mills.***This output seeks to develop the further activities:* support the preparation of the studies required to get the environmental permits for mills #1, #2 and #3; and
* support the preparation of the studies required to get the environmental permits for mills #1, #2 and #3 by means of technical, economic and environmental assessments.

 ***Output #3.3 Guidelines for environmentally acceptable implementation of trash utilization (collecting/processing).***This output seeks to develop the further activities:* evolution of preventive and corrective measures related with trash use;
* definition of basic parameters for monitoring the trash system;
* preparation of guidelines; and
* assistance to guidelines preparation with recommendations for environmentally acceptable implementation of trash utilization (collecting/processing) by means of technical, economic and environmental assessments.

**Outcome # 4: Sugarcane trash is being utilized across the sugarcane sector with private investment taking benefit from lessons learned.** ***Output #4.1 A template has been developed for the appraisal of trash utilization projects by the sugarcane sector.***This output seeks to develop the further activities:* definition of methodology/criteria;
* development of a template for the appraisal of trash utilization projects by the sugarcane sector; and
* dissemination of guidelines.

 ***Output #4.2 Trash utilization system for electricity production have been installed in first batch of sugar mills (initially3).***This output seeks to develop the further activities:* estimate trash availability and amount of trash to be recovered for mills #1, #2 and #3;
* trash recovery strategy, harvesting equipment specification, harvesting equipment configuration and quality of each equipment for mills #2 and #3;
* basic implementation project for mills #2 and #3; and
* follow up of trash system plant construction for mills #2 and #3; building and commissioning.

 ***Output #4.3 Expert support has been provided to carry out feasibility studies for trash utilization systems in second batch of sugar mills (initially 7).***This output seeks to develop the further activities:* selection of sugarcane mills; and
* technical, economic and environmental feasibility studies (considering agricultural, transport and industrial phases) for sugarcane trash collection and processing (electricity generation) investments in second batch (envisaged: 7) of sugar mills.

 ***Output #4.4 Investment for second batch of sugar mills has been leveraged.***This output seeks to develop the further activity:* select sugar mill on the basis of financial commitment to project.

 ***Output #4.5 Development of a database structure to support the implementation and dissemination of the project.***This output seeks to develop the further activities:* database structure;
* development of a web GIS tool for dissemination; and
* development of a blog as an information tool.

 ***Output #4.6 Remote sensing as a tool to implement the system in mills.***This output seeks to develop the further activities:* sugarcane Maps; and
* straw estimation using satellite data.

**Outcome #5: An adequate legal and regulatory framework is in place to promote the sustainable use of sugarcane trash for electricity generation and sales to the grid.** ***Output #5.1 Updated study of regulatory barriers and opportunities regarding participation in the electricity market.***This output seeks to develop the further activity:* study of the electrical sector legislation and EE sales contracts.

 ***Output #5.2 Analytical support to sugarcane sector stakeholders regarding institutional, regulatory and legal aspects of electricity generation.***This output foresee further activities:* study of regulatory opportunities and barriers, identifying options to overcome the identified barriers;
* technical support to institutional studies (aiming on overcoming barriers);
* provide legal/regulatory advice to sugarcane industry investors regarding electricity sales to grid; and
* Provide legal/regulatory advice to relevant stakeholders regarding contracting for trash supply.

 ***Output #5.3 Regulatory changes to support trash utilization for electricity generation are promoted for formal approval.***This output seeks to develop the further activities:* analyze potential impact of alternative regulatory changes on industry-wide trash-to-electricity generation; and
* interact with government in pursuit of regulatory changes that would facilitate greater trash-to-electricity implementation.

**Outcome # 6: Project monitoring, learning, adaptive feedback and evaluation.** ***Output #6.1 Project monitoring and results evaluation.***This output foreseen further activities:* conduct project internal monitoring; and
* conduct Midterm and Final Evaluations.

 ***Output #6.2 Lessons learned and adaptive feedback.***This output foresee further activities:* adjust project strategy according to feedback obtained during project implementation; and
* contribute to the preparation of lessons learned and adaptive feedback.
 | a)SUCRE initiated with activities to Project accomplished: - **Inception Workshop, June/2015**b)Information for new baselines for 04 mills; - **Da Pedra Mill showed on RLT – Baseline Description.****In 2014/2015 season**, Da Pedra, Quatá and Alta Mogiana mills exported together 545,834 MWh to the grid (Alta Mogiana 149,437 MWh, da Pedra 308,603 MWh and Quatá 87,793 MWh) averaging 45 kWh/per ton of crushed sugarcane. Barriers to increasing trash/bagasse ratio to more than 10% in weight evaluated through assessment of the boilers performance (burning systems, corrosion, erosion and deposits problems). Tests are in progress in the Granelli and São Luis de Ourinhos mills aiming to reduce the mineral impurities level and potassium, chlorine and sulfur contents to acceptable values by a washing trash system.- Methodology for economic and environmental evaluation of trash collection – 4 mills;- **Da Pedra Mill is in advanced stage based on its baseline description-****RLT004 – Baseline Description – Da Pedra Mill.** - Field experiments carried out in 18 sites already established to assess the impacts of leaving different amounts of trash over the soil, under different soil and weather conditions. Impacts on cane yields are evaluated and the experiments for the other impacts (GHG soil emissions, soil carbon stock, water balance, pests and weeds) are in advanced planning stage.**Products sent to UNDP during 2015**RLT – 001 Inception Workshop Report RLT – 002 SUCRE AWP 2015 RLT – 003 Institutional and Regulatory AWP 2015 (Outcome 5 Report) RLT – 004 Baseline Description – Da Pedra Mill RLT – 005 Field Experiments Description RLT – 006 Regulatory Barriers Study Preparation RLT – 007 AWP 2016 SUCRE Newsletter #1 (in Portuguese) SUCRE website preliminary version (http://pages.cnpem.br/sucre/) - Activities related to outcome 4, estimates of trash availability carried out by literature review and field experiments associated to the trash collection routes in the four participating mills. The Project Database structure definition was progress rapidly and the part associated with laboratory samples and analyses is nearly operational. The project blog was preliminarily operational and being tested; the first Newsletter in Portuguese was published in December 2015 and is being translated to an English version. Newsletter #2 was planned for early 2016.**Products sent to UNDP during 2015**RLT – 001 Inception Workshop Report RLT – 002 SUCRE AWP 2015 RLT – 003 Institutional and Regulatory AWP 2015 (Outcome 5 Report) RLT – 004 Baseline Description – Da Pedra Mill RLT – 005 Field Experiments Description RLT – 006 Regulatory Barriers Study Preparation RLT – 007 AWP 2016 SUCRE Newsletter #1 (in Portuguese) SUCRE website preliminary version (http://pages.cnpem.br/sucre/) - Activities related to Outcome 5: the preliminary study of the regulatory opportunities and barriers was completed and used to produce the Terms of Reference for hiring the necessary consulting services to produce the final document. This is a key activity since it will guide the system simulation and will be used for discussions with government agencies and the sugarcane sector.**Products sent to UNDP during 2015**RLT – 001 Inception Workshop Report RLT – 002 SUCRE AWP 2015 RLT – 003 Institutional and Regulatory AWP 2015 (Outcome 5 Report) RLT – 004 Baseline Description – Da Pedra Mill RLT – 005 Field Experiments Description RLT – 006 Regulatory Barriers Study Preparation RLT – 007 AWP 2016 SUCRE Newsletter #1 (in Portuguese) SUCRE website preliminary version (http://pages.cnpem.br/sucre/) - Activities on Outcome 6 consider that, in mid-2015, the contribution of CTBE to the Project Implementation Review (PIR 2015) was prepared and sent to UNDP for incorporation in the final document. **Products sent to UNDP/201**5In addition to other products in 2015 mentioned above, it was sent to UNDP:- Project Implementation Review (PIR 2015). | a) The activities in Outcome 1 were focused on the collection of samples and data in three out of four mills (Quatá, Da Pedra and Alta Mogiana mills);- **Field travels and data collection were intensified/collecting great amount of trash.** b) Actions to establish cooperation agreements. **Products sent to UNDP in 12/2016**1. Cooperation Agreement CNPEM/CTBE & partners: Quatá, UNICA, Da Pedra.2. RLT 008 – Baseline Description – Quatá, Da Pedra and Alta Mogiana Mills.3 RLT 010 – Trash Recovery and Transport Operations - State of the Art.4. RLT 012 – Dry Cleaning System Evaluation – Partial Results.5. RLT 013 – Trash Recovery by Baling – System Evaluation – Partial Results.- In 2016 Outcome 2 activities aimed at model adjustments and documentation. Previous tools were aggregated and adapted to represent the three partner mills baseline conditions. The adapted model applied in economic feasibility evaluations of different electricity production and commercialization scenarios. Time schedule was delayed in Outcome 5 executions, since electricity commercialization conditions are important in scenarios definition on Outcome 2.**Products/sent to UNDP in 12/2016**1. Cooperation Agreement CNPEM/CTBE & partners: Quatá, UNICA, Da Pedra.2. RLT oo8 – Baseline Description – Quatá, Da Pedra and Alta Mogiana Mills.3 RLT 010 – Trash Recovery and Transport Operations - State of the Art.4. RLT 012 – Dry Cleaning System Evaluation – Partial Results.5. RLT 013 – Trash Recovery by Baling – System Evaluation – Partial Results.6. RLT 014 – Methodology for Economic and Environmental Evaluation – Partial Results 7. RLT 015 – Electricity Production Scenarios Assessment – Partial Results 8. RLT 016 – Technical, Economic and Environmental Feasibility Studies – Partial Results 9. RLT 017 – Field Experiments Monitoring – Pests-Partial Results 10. RLT 018 – Field Experiments Monitoring – Impact on Production System – Partial Results 11. RLT 019 – Modeling Documentation 12. RLT 020 – Conceptual Model and Operation of the Geographical Database 13. RLT 021 – Sugarcane Mapping Model Documentation (Partial) 14. Project Database Operational – Available for CTBE **15. SUCRE NEWSLETTER #2 #3 #4 and #5** 16. RLT – 023 – AWP/2017 2016 activities focused in field experiments setup. New trials regarding GHG emission from soil and soil compaction finished in October. Progress in pest and weed evaluation achieved and partial results delivered in December. Literature information about results grouped in a substantial review were submitted to an important international journal (Global Change Biology and Bioenergy) and will be published. Partial results on sugarcane yield under different trash removal levels will be delivered this year.**Products/sent to UNDP in 12/2016**1. Cooperation Agreement CNPEM/CTBE & partners: Quatá, UNICA, Da Pedra.2. RLT oo8 – Baseline Description – Quatá, Da Pedra and Alta Mogiana Mills.3 RLT 010 – Trash Recovery and Transport Operations - State of the Art.4. RLT 012 – Dry Cleaning System Evaluation – Partial Results.5. RLT 013 – Trash Recovery by Baling – System Evaluation – Partial Results.6. RLT 014 – Methodology for Economic and Environmental Evaluation – Partial Results 7. RLT 015 – Electricity Production Scenarios Assessment – Partial Results 8. RLT 016 – Technical, Economic and Environmental Feasibility Studies – Partial Results 9. RLT 017 – Field Experiments Monitoring – Pests - Partial Results 10. RLT 018 – Field Experiments Monitoring – Impact on Production System – Partial Results 11. RLT 019 – Modeling Documentation 12. RLT 020 – Conceptual Model and Operation of the Geographical Database 13. RLT 021 – Sugarcane Mapping Model Documentation (Partial) 14. Project Database Operational – Available for CTBE **15. SUCRE NEWSLETTER #2 #3 #4 and #5** 16. RLT – 023 – AWP/2017\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- Activities related to outcome 4/2016 about the model requirements to evaluate results regarding environmental, economic and technical issues in the partner mills started to be designed. A partial report with the first advances in results integration will be delivered. Meetings and visits were attended in order to prospect possible partners to integrate Batch 2. Some of the visited mills were very engaged in signing a cooperation agreement with CTBE and work plans was discussed between the parts. The project website was improved and access to the website information duplicated since last year. Four newsletters released in 2016 and the Project team also invested in other social media, such as Facebook. An internal workshop was held in November to present and discuss the Project results so far. This event was the basis for the next workshop that will present the results to the external public and will take place in the first semester of 2017.**Products/sent to UNDP in 12/2016**1. Cooperation Agreement CNPEM/CTBE & partners: Quatá, UNICA, Da Pedra.2. RLT 008 – Baseline Description – Quatá, Da Pedra and Alta Mogiana Mills.3 RLT 010 – Trash Recovery and Transport Operations - State of the Art.4. RLT 012 – Dry Cleaning System Evaluation – Partial Results.5. RLT 013 – Trash Recovery by Baling – System Evaluation – Partial Results.6. RLT 014 – Methodology for Economic and Environmental Evaluation – Partial Results 7. RLT 015 – Electricity Production Scenarios Assessment – Partial Results 8. RLT 016 – Technical, Economic and Environmental Feasibility Studies – Partial Results 9. RLT 017 – Field Experiments Monitoring – Pests - Partial Results 10. RLT 018 – Field Experiments Monitoring – Impact on Production System – Partial Results 11. RLT 019 – Modeling Documentation 12. RLT 020 – Conceptual Model and Operation of the Geographical Database 13. RLT 021 – Sugarcane Mapping Model Documentation (Partial) 14. Project Database Operational – Available for CTBE **15. SUCRE NEWSLETTER #2 #3 #4 and #5** 16. RLT – 023 – AWP/2017- The activities related to Outcome 5 consider the major deliverable in 2016 that was the legal and regulatory barriers study that also will feed Outcome 2 on economic feasibility and will promote the meetings with government agencies for incentives negotiation. Issues involving the documents adjustments to CNPEM Legal advice requirements led to a delay of four to five months in the delivery of the Final report. Nevertheless, it is expect that the subsequent activities will be completed within the original time schedule.**Products/sent to UNDP in 12/2016**1. Cooperation Agreement CNPEM/CTBE & partners: Quatá, UNICA, Da Pedra.2. RLT oo8 – Baseline Description – Quatá, Da Pedra and Alta Mogiana Mills.3 RLT 010 – Trash Recovery and Transport Operations - State of the Art.4. RLT 012 – Dry Cleaning System Evaluation – Partial Results.5. RLT 013 – Trash Recovery by Baling – System Evaluation – Partial Results.6. RLT 014 – Methodology for Economic and Environmental Evaluation – Partial Results 7. RLT 015 – Electricity Production Scenarios Assessment – Partial Results 8. RLT 016 – Technical, Economic and Environmental Feasibility Studies – Partial Results 9. RLT 017 – Field Experiments Monitoring – Pest - Partial Results 10. RLT 018 – Field Experiments Monitoring – Impact on Production System – Partial Results 11. RLT 019 – Modeling Documentation 12. RLT 020 – Conceptual Model and Operation of the Geographical Database 13. RLT 021 – Sugarcane Mapping Model Documentation (Partial) 14. Project Database Operational – Available for CTBE **15. SUCRE NEWSLETTER #2 #3 #4 and #5** 16. RLT – 023 – AWP/2017- In mid-2016, the CTBE contribution to the Project Implementation Review(PIR 2016) was prepared and sent to UNDP for incorporation in the final document. **Products sent to UNDP/2016**- PIR 2016 sent to UNDP. | a) Activities/2017 focused in finishing the evaluation of the trash collection, processing and burning systems in at least one mill - Batch 1. Report with results sent to Quatá mill. Reports for each Batch 1 mills and conclusions on trash collection, processing and burning are in progress with recommendations to improve quality for extensive use of this biomass to power generation. b) Tests were in progress.**Products:**1. **Outcome 1** & Management: Cooperation Agreement CNPEM/CTBE & Partner Mills 2. **Outcome 1 & 2**: RLT 008 – Baseline Description Quatá, Da Barra, Da Pedra and Alta Mogiana Mills 3. **Outcome 1 & 2**: RLT 009– Trash Recovery Quality Assessment – Guidelines to reduce Mineral Impurity. 4. **Outcome 1 & 2**: RLT 026 – Trash Recovery by whole Harvesting – System Evaluation – Partial Results. 5. **Outcome 1 & 2**: RLT 027 – Trash Recovery by Harvesting System Evaluation. 6. **Outcome 1 & 2**: RLT 028 – Dry Cleaning System Evaluation. 7. **Outcome 1 & 2**: RLT 029 – Straw System Evaluation – Baler – Partial Results. 8. **Outcome 1 & 2**: RLT 030– Straw Processing Evaluation Hay Harvester.9. **Outcome 1 & 2**: RLT 031 – Guidelines for Sugarcane Straw Recovery and Processing (Field and Industry). The economic model for trash collection and processing was adapted and validated to be used for economic feasibility evaluation in three of the four partner mills, with good accuracy compared with the real data. They are being evaluated to increase revenues and to demonstrate sugarcane trash collection and use economic advantages. Results for three of the four partner mills were delivered by December, 2017. Results about regulatory barriers feeding the economic feasibility studies and the models set to simulate different configurations in collection, processing and burning of sugarcane trash for EE generation for Batch 1 mills and for a generic mill, with different levels of specificity, which will be used during the Batch 2.**Products/sent to UNDP in 12/2016****Outcome 2:** RLT 032 – Methodology for Economic and Environmental Evaluation. **Outcome 2**: RLT 033 – Electricity Production Scenarios Assessment. **Outcome 2**: RLT 034 – Technical, Economic and Environmental Feasibility Studies. **Outcome 2:** RLT 035 – Expert Assistance to Support Business Development and PPA Contracting by First Batch of Sugar Mills – Partial Results Activities on outcome 3/2017: data from the field experiments were analyzed and preliminary figures available. Partial results indicate that the amount of trash which should be left on the soil to maintain sugarcane yield and reduce environmental impacts, e.g. soil erosion, nutrient losses and greenhouse gas emissions, is highly dependent on local edapho-climatic conditions. A report with agronomic and environmental recommendations for Mill #1 (Quatá) was prepared. A great portion of the trash should be left on the soil surface in order to reduce soil erosion and to maintain sugarcane productivity, because the mill is located on sandy soils with low soil organic matter content, subject to a certain level of water stress during the sugarcane growth. Estimates of GHG emission reduction due to the excess electricity generated by trash burning and exported to the national grid will be completed for Mill #1 by the end of 2017. Quantification of soil emissions was regionalized using the results from the field experiments in order to better represent local conditions. Results will be extended to regional areas using modelling. Deforestation was quantified at country and basin levels regarding the recent period of sugarcane expansion in Brazil. Results showed that sugarcane mainly displaced pasture and annual crops, with small or null expansion over native vegetation. A paper with detailed data and calculations was presented at the European Biomass Conference, in June, 2017.**Products sent to UNDP in 12/2017****OUTCOME 3:** RLT 038 – Evaluation of the Impacts of Sugarcane Straw Removal on Soil Quality - Partial results **OUTCOME 3:** RLT 039 – Evaluation of the Impacts of Sugarcane Straw Removal on Environment - Partial results **OUTCOME 3:** RLT 040 – Evaluation of the Impacts of Sugarcane Straw Removal on Sugarcane Development and Yields - Partial results - Activities related to outcome 4: the SUCRE team prospected seven mills to compose the Batch 2, with preliminary tests and calculations performed in four. A cooperation agreement was signed by Santa Isabel mill and two other agreements are under review (Caeté and São Luis mills). Recommendations regarding trash collection, processing and burning for mills #2, #3 and #4 are expected to be delivered in 2018. For at least two of the four partner mills, reports showing the development of biomass-based electricity generation delivered in December, 2017. All four mills in Batch 1 have already made significant investments in trash collection and processing and energy systems upgrade. Around R$12 million was invested in the Alta Mogiana mill by the mill itself, CTC and FINEP, corresponding to the installation of the Dry Cleaning System and trash processing equipment. In Batch 2, the CerradinhoBio mill purchased and installed a large and modern boiler (fluidized bed type) and considered investing in trash collection and use (or other alternate biomass) to increase power generation. The announced cost of this investment is R$105 million. Studies to support further investment regarding economic feasibility and environmental aspects of electricity generation started for Santa Isabel mill and were prepared for the other mills on Batch 2. Regarding dissemination, the newsletter mailing list and the Website (http://pages.cnpem.br/sucre/) were updated. In 2017, two workshops about regulatory barriers have been organized, one at the UNICA headquarters and one at CTBE, both to present and discuss results with government agencies and the associated mills. Two other workshops will be organized in the second semester of 2017, one about Outcome 5 results (August at FENASUCRO, Sertãozinho), and one about the Midterm project results (October at CTBE, Campinas). The project data are being stored in the information supporting systems at the CTBE facility to provide backup and access to the project team. Full reports and results will be available for public download on the SUCRE website. Technical articles were presented at the 2017 European Biomass Conference and more studies were submitted to the third BBEST conference. Collaboration agreements developed with Cenicaña, in Colombia, and with the International Sugarcane Biomass Users Consortium (ISBUC).**Products sent to UNDP/12-2017 related do Outcome 4**RLT 036 – Criteria for Selecting Sugarcane Mills to be Evaluated in Batch 2 RLT 037 – Conceptualization of a Template for the Appraisal of Trash Utilization Projects by the Sugarcane Sector RLT 041 – Sugarcane Maps for Partner Mills RLT 042 – Description of the Sugarcane Yield Estimation model RLT 043 – Sugarcane and Straw Yield Map for Mill #1 RLT 020 – Conceptual Model and Operation of the Geographical Database RLT 044 – Brazilian Sugarcane Expansion and Deforestation SUCRE NEWSLETTER #8 #9 #10 #11 #12 and #13 WEBGIS Tool to Dissemination RLT 045 – Database Structure Documentation - Dissemination Workshop – Mill #1 - Activities for Outcome 5 consider the study of the regulatory barriers and the suggestions to overcome them was finished in June, 2017. Negotiation with government and other agencies involved in the regulatory framework for biomass-based electricity started and important results are expected to be achieved this year. Aiming at improving the current Regulatory and Legal Framework of the Brazilian electric sector, the Ministry of Mines and Energy disclosed a technical document available for public consultation. The time seems right to present suggestions, which include the contributions that consider the point of view of sugarcane bioelectricity producers. In this context, the main stakeholders and agents involved in sugarcane bioelectricity production and trade attended the Workshop organized by CTBE in July 20, 2017, where these topics were presented and discussed. A report with suggestions to overcome the identified barriers was finished and submitted to public consultation.**Products sent to UNDP/12-2017**- RLT 022 – Study of Regulatory Barriers to Power Commercialization by the Mills - BOOKLET 01 – Installation and Commercialization of Energy - SEMINAR – Installation and Commercialization of Energy - MANAGEMENT: RLT – 046 – AWP 2018 - Activities developed: in mid-2017, the CTBE contribution to the Project Implementation Review (PIR 2017) was prepared and sent to UNDP for incorporation in the final document. The first meeting of the Project Advisory Committee (PAC) was held in June this year.**Products sent to UNDP/2017**- Project Implementation Review (PIR 2017) was prepared and sent to UNDP.- Report about the meeting of the Project Advisory Committee (PAC) hold in June 2017.  |

Source: CTBE/SUCRE Progress Report 2015/2016/2017/2018.

- Assessment of risks and assumptions and any mitigation measures undertaken during semester:

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| Major risks were related to the economic and political instability in Brazil. From an economic point of view, even if the regulatory and legal framework for biomass based electricity production and commercialization was improved, there is the risk that the mills do not invest in electricity production expansion until the sugar market is way more stable. Regarding the current political situation, changes and improvements that depend on government decisions are likely to be delayed. Moreover, the near future scenario seems to be similar and there will be presidential and state government elections in 2018, which disturb even more government dependent outputs. In this case, the association with important representatives from sugarcane sector was a measure of risk mitigation since together with those stakeholders the chances of having the claims met were higher. - Assessment of implementation during semester:  |

Briefly provide a piece of information for communication purposes for this period:

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| --- |
| It is important to remark the kickoff of the Batch 2 activities and the rising interest of the sector (mills) in being part of the Project. Several partners already made changes in equipment and operational configurations based on the Project results and the mills are demonstrating rising interest in the Project results in order to support decision making in straw collection, processing and burning for electricity purposes.  |

 **3.2.2 Remaining Barriers to Achieving the Project Objectives**

No major barriers were identified in the implementation of this Project so far, since its objective completes the actions of identification, experimentation and use of appropriate technologies and procedures for the export and commercialization of electric energy from sugarcane residues to the national electricity grid.The commitments of the parties involved are in line with the ultimate purpose, namely, which involves reducing greenhouse gas emissions.

The main risks and mitigation strategies for the SUCRE Project that were identified in the Substantive Review, the new PRODOC, are listed in Table 3.

**Table 3: Risks that the Project may face and Mitigation Strategies**

|  |  |  |
| --- | --- | --- |
| **Risk** | **Threat level to Project****Success** | **Possible Mitigation** **Strategies** |
| **Technical:** The technology for trash recovery and use is not viable. This risk is considered minimal since the project “Biomass Power Generation” (GEF ID 338) has conducted testing in the field. | Low | - None |
| **Economic risks:** Trash recovery and use is not economically viable. This risk is considered low as a result of the economic modeling that has been developed, which shows that prices of electricity generated with bagasse and trash are highly competitive related to fossil fuel based generation.  | Low | - Strive to reduce production costs as much as possible to ensure competitiveness |
|  **Financial collapse of the sugarcane sector:** This risk is minimal or almost nil as sugarcane is considered today to be far and away the best feedstock for the production of sugar and alcohol, and new technologies are making the Brazilian sugarcane sector increasing competitive. | Low | - None needed |
| **Electricity prices fall:** Massive investment in new power plants, and decreases in fossil fuel (natural gas) prices result in new supply of thermal electricity, bringing prices to very low levels. This risk is very small, as electricity demand has been increasing and the trend in fossil fuel prices is upwards. Furthermore, there is pressure to substitute unrenewable energy with renewable energy that reduces GHG emissions. The best assessments to date of the cost of electricity from sugarcane trash suggest that electricity prices would need to fall quite far before the competitiveness of sugarcane electricity is threatened. | Low | - Reduce production cost as much as possible to ensure competitiveness. |
| **Market factors can make other mills production****- a higher priority**: As the increasing demand for sugar and/or alcohol makes these prices more interesting than investment in the electricity area. This is still only a moderate risk because there is growing strong interest in biofuels, and the returns on investments in trash for electricity are likely to be quite favorable. Efforts to optimize technology can help mitigate this risk. | Moderate | - Maximize rate of return achievable with trash-to-electricity.- Pursue third party (energy-service company) investor/operator concept for trash-to-electricity system. |
| **Climate change:** it has a negative effect on trash-to-electricity system | Low | - None identified |
| **Environmental risks:** The expansion of the sugarcane sector may have a negative environmental impact on land use in Brazil. The sugarcane sector actually uses a small proportion of agricultural land in Brazil and is located far from the most vulnerable regions, such as the Amazon. The project promotes an increase in energy yield per hectare, therefore not directly promoting the sector’s expansion. Considering the ongoing worldwide debate regarding the use of biomass for energy production, the project will have a specific monitoring component dedicated to this issue. A targeted analysis of this issue must be conducted by the Project, clarifying the potential direct and indirect links between sugarcane expansion and land use change in Brazil. | Low | - Assessment conducted prior to project initiation, constant monitoring and research on this issue throughout project execution. |
| **Licensing:** Delays due to slow pace of environmental permitting. | Moderate | - Government representation (MCTIC) on Project Steering Committee may help in speeding up the licensing process. |

Source: Substantive Revision 1 (PRODOC) signed on April 20, 2015.

According to the MTR, there is moderate risk regarding regulatory barriers. Despite the partnership between the Project and UNICA, clear and appropriate regulatory definitions by the Brazilian government are still lacking. It is expected that the new federal administration in 2019 will overcome these risks. There can be further expansion of benefits through wider strategic dissemination regarding the problems and solutions.

The barriers to the expansion of the sugarcane bioelectricity that were identified in the Excelência Energética Consultoria Empresarial Ltda. report were:

* Unpredictability of the sale price in the Short-Term Market (MCP).
* Prorated default among MCP creditors.
* Guarantee of regulated contracts.
* Devaluation by buyers of the Free Contracting Environment (ACL), of the seasonal generation.
* Short-term contracts in the ACL.
* Lack of effective socio-environmental policy in the ACL.
* Public calls of the Distributed Generation (DG) inoperative.
* Financing in the form of Project finance.
* Lack of price ceiling.
* Lack of long-term planning signal for biomass, among others.

For the future, these barriers may constitute risks to the achievement of the objectives of the SUCRE Project. The partial scope of the result related to the establishment of procedures and standards for the commercialization of electric energy generated by sugarcane residues can impact the economic feasibility of this production, according to the MTR analysis. Overall, risks raised are moderate or even low, because of the support of established partnerships and the hiring of qualified specialists.

[**3.3 Project Implementation**](#_Toc416275494) **and Adaptive Management**

 **3.3.1 Management Arrangement**

Adaptive management is a structured and systematic process for improving management during project implementation, as well as making improvements to management decisions, policies and practices, learning from outcomes and outputs related to Project objectives.

Project BRA/10/G31 on “Sugarcane Renewable Electricity” was formulated with precise and specific objectives and means to obtain results and products, as set out in the PRODOC. The change in the former Executing Agency’s (CTC) legal status hindered the continuity of the project as originally envisaged. The previous start date was 2011. Therefore, UNDP undertook an assessment to determine the viability of project implementation by another institution and CTBE was selected. Thus, a Substantive Review was necessary.

The Substantive Review that modified the original PRODOC can be considered adaptive management. During Project implementation, other revisions may be necessary, but only in terms of altering product delivery dates to achieve the final results and to establish new dates for ending Project activities. The revisions must be submitted to and approved by the Brazilian Cooperation Agency (ABC) and by UNDP, as was done.

According to the MTR and considering that the above explanation of changes in the design of the Project and its coordination, implementation to date has not changed. However, as the MTR identified, as part of adaptive management, the Project should be extended beyond the original end date given that the beginning of the project was postponed due to change of the executing agency and consequent delays in signature and inception of the Project.

The Project and its activities lead to the disbursement of financial resources and actions of human resources with minimal waste, in order to achieve the outcomes and partial outputs. The Project has been implemented efficiently in accordance with international and national norms and standards.

According to the MTR, the planned and ongoing actions have been made possible through the appropriate arrangements established to carry out what is foreseen in the Annual Work Plan. Management arrangements include work planning, finance and co-finance, project-level monitoring and evaluation systems, stakeholder engagement, reporting and communications.

Figure 1 shows the management arrangements established in the PRODOC that constitute the Project organizational structure.

**Figure 1: Project Organizational Structure**



The project is carried out by CTBE (Brazilian Bioethanol Science and Technology Laboratory), which is part of the National Research Center on Energy and Materials (CNPEM) with UNDP as the GEF implementing agency. CTBE coordinates the project and designated a Technical Coordination Team (TCT) composed by a National Project Director, the Assistant National Project Director, a Technical Manager, a Financial Manager, an Environmental Manager, a Legal Manager and a Dissemination Manager. The TCT is responsible for overseeing day-to-day implementation of Project activities, including supervision of the project activities sub-contracted to specialists and institutions, whenever applicable. The TCT is responsible for the project’s operational planning, supervision and administrative and financial management and the adaptive management of the Project based on inputs from the Project M&E plan.

The Brazilian government is represented by the MCTIC and by the Brazilian Cooperation Agency (ABC/MRE), which monitor the actions of the Project by analyzing annual reports in electronic form (RPE) of the Project Follow-up Information System (SIGAP) as well as visits and periodic tripartite meetings, verifying compliance with the objectives, goals and results of the Project.

The structure attributes to Project Board (PB) responsibility to provide guidance for Project execution. The PB attributions are:

* analyze and discuss the Project activities, recommending changes as required based on the monitoring and evaluation process;
* discuss and approve the annual work plan (AWP);
* discuss and approve the Progress Reports and Final Report of the Project;
* analyze achievements to improve performance and accountability;
* settle controversies by arbitrating and negotiating solutions to the problems.

The PB is composed of UNDP, ABC and CTBE. UNDP has represented the project ownership, chairing the PB and organizing its meetings. The ABC follows the activities underway or planned. CTBE represent the parties that provide funding for cost-sharing and provides technical expertise and guidance to the Project.

PB management has received inputs and recommendations from the Project Advisory Committee (PAC). It is composed of CTBE, UNDP, the investing mills, the Brazilian government (MCTIC) and the NPD. The PAC holds annual meetings to evaluate the activities of the Project and analyze the process and results of implementation to guide execution of the remaining Project actions.

The National Project Director (NPD) is responsible for overall project management. The NPD is also the formal link with the funding institutions, investing mills or investors, cane growers, utilities, NGOs, UNICA, governmental institutions and the external public in general. The NPD is in charge of preparing meetings of the Project Steering Committee (PSC), as well as all monitoring and evaluation efforts.

Furthermore, UNDP provides Project Assurance support to the Project Board Executive by carrying out objective and independent project oversight and monitoring functions related to UNDP project cycle management services as GEF Implementing Agency.

**Implementation Strategy**

According to the MTR the CTBE technical team has coordinated the Project activities approved by the PBE and contained in the Annual Work Plans to be carried out within the Project scope. UNDP technical experts and the CTBE Technical Team have been responsible for identifying and developing new partnerships and linkages with other government projects or programs that support or complement the results of Project BRA/10/G31, as set forth in the PRODOC.

The execution of administrative and financial services, including authorization of expenditures, has complied with both UNDP and CNPEM rules, standards and procedures. UNDP has been responsible for planning and execution of technical and operational actions, contract supervision and other administrative duties, as well as financial and administrative management of approved activities.

**Project Audit Arrangements**

Independent auditing contracted by the Project has been carried out as provided for in UNDP rules. Under this project modality, the UNDP Brazil office has been responsible for the full implementation of UNDP rules and procedures in Project execution, monitoring and evaluation. The office has maintained and made available records about the Project in institutional databases.

**Review Mechanisms**

The financial reviews have been signed by the UNDP Resident Representative in Brazil, which are: a) reviews reflecting more realistic estimates of financial implementation for the current year and to reschedule the remaining resources for the coming year that do not involve a change in the amount of the total budget; b) annual mandatory reviews, reflecting expenditures made during the previous year that do not change the total budget amount, the Project timeframe or its substantive nature; c) simplified reviews. Other revisions require the signature of the three parties involved in the Project implementation and coordination.

**Monitoring and Evaluation**

According to the Evaluator, the monitoring has included provision of regular information to the CNPEM/CTBE. The Semi-annual Implementation Reports (Progress Reports) and the Annual Work Plan have been and are being prepared and submitted for evaluation to the Annual Tripartite Meeting (TPR) which includes the Parties involved in the Project.

CTBE has prepared the Electronic Progress Report (RPE) for the technical module of the Project Management Information System (SIGAP) reflecting the Project’s physical performance, that is, the achievement of the programmed physical goals.

The monitoring of indicators of the Results and Resources Matrix has been carried out by UNDP and its inputs have oriented adjustments to the Project activities, providing the basis for decision-making. This has enabled monitoring and evaluation results that supported the planning and implementation of actions at the local level.

In accordance with the program policies and procedures described in UNDP’s Guide for Results Management (GGR), the Project has been monitored through: a) regular meetings between the UNDP and the CTBE team to monitor the Project progress; b) semi-annual quality assessment recording the progress made on the basis of quality criteria and methods defined in the Quality Management Framework and in the Atlas system; c) Project Issues Register (Issues Log) activated in Atlas and updated by the UNDP Project Manager; d) based on the risk analysis, a Risk Register has been updated in Atlas; e) based on the information recorded in the Atlas, a Semiannual Progress Report has been prepared by the Project Manager through Project Quality Control using the standard report available in the Executive Snapshot (Atlas); f) a Lessons Learned Log has been activated and updated in Atlas, ensuring learning and constant adaptation within the organization, and facilitating the preparation of the Lessons Learned Report at the end of the Project; g) a Monitoring Plan has been activated and updated in Atlas, tracking the main management actions and events.

The results of this MTR should provide inputs for final evaluation of the Project, verifying if the objectives have been achieved and if the outcomes sustainability will be effective and identifying lessons learned as inputs to other projects.

The arrangements to administrate the partnerships involved in the Project have been made through formal cooperation agreements. These documents are presented in the Table 4: Cooperation Agreements between sugarcane mills and CTBE/UNDP

 **3.3.2 Work Planning**

After the Substantive Review, all the annual work plans were prepared by the SUCRE Project team and the work was carried out as planned. The plans are results-based. No changes were made in the log-frame.

 **3.3.3 Finance and Co-Financing**

 **SUCRE Project Finance**

As already mentioned, the SUCRE Project has the CTBE/CNPEM as its executing agency and UNDP as its implementing agency. In approving the Brazilian proposal for the Project implementation on April 20, 2015, the resources allocated by GEF were in the amount of US$7,744,313.60, but, as the amount of US$55,686.40 was utilized in 2014 and before, the total amount was US$7,800,000.00, according to Substantive Revision of the previous PRODOC. These resources have been used in accordance with the budget approved by CTBE/ABC/GEF-UNDP and have been planned and disbursed in accordance with Annual Work Plans.

The funds have been used in accordance with budget provisions by outcome/output and have been monitored by UNDP as the Project implementing agency. The Project Management Unit at CNPEM-CTBE has been responsible for financial monitoring and administrative coordination, overseeing and monitoring expenditures, equipment purchase and product delivery, in accordance with the M&E Plan inputs.

The tables with project budget specifications by year are presented below.

**Table 5: Financial Performance by Year**

|  |
| --- |
| **Project: 00051455****Project Title: BRA/10/G31 – SUCRE – Sugarcane Renewable Electricity****Start year: 2015****End year: 2019****Implementing Partner: UNDP****Executing Agency: CTBE/CNPEM****Revision Type: Substantive Revision 1** |
| **Project Budget 2015** |
| **Account** | **Budget US$** | **Executed** | **Balance** |
| 71600 – Travel | 15,835,22 | 6,492,98 | 9,342,24 |
| 72200 - Equipment and Furniture | 243,495,50 | 229,324,46 | 14,171,04 |
| 72300 - Materials & Goods | 16,820,44 | 10,090,78 | 6,729,66 |
| 72500 - Supplies  | 4,379,83 | 4,379,82 | 0,01 |
| 72100 - Contractual Service-Companies | 27,214,23 | 10,122,50 | 17,091,73 |
| 72800 - Information Technology Equipment | 36,099,89 | 31,989,88 | 4,110,01 |
| 72400 – Communic. & Audio Visual Equip  | 2,618,44 | 1,129,73 | 1,488,71 |
| 71200 - International Consultants  | -  | - | - |
| 71300 - Local Consultants | 118,030,91 | 93,788,74 | 24,242,17 |
| 72400 - Rental & Maint of Other Equipment | 1,723,08 | 1,723,09 | -0,01 |
| 74500 - Miscellaneous Expenses | 1,400,00 | - | 1,400,00 |
| 74700 - Transport, Shipping and Handling | 32,784,59 | 823,36 | 31,961,13 |
| **Sub-total** | **500,402,13** | **389,865,33** | **110,536,80** |

Source: SUCRE Progress Report by year.

|  |
| --- |
| **Project: 00051455** |
| **Project Title: BRA/10/G31 – SUCRE – Sugarcane Renewable Electricity** |
| **Start year: 2015** |
| **End year: 2019** |
| **Implementing Partner: UNDP** |
| **Executing Agency: CTBE/CNPEM** |
| **Revision Type: Substantive Revision 1** |
|  |
| **Project Budget 2016** |
| **Account** | **Budget US$** | **Executed** | **Balance** |
| 71600 – Travel | 160,462.86 | 43,244.70 | 117,218.16 |
| 72200 - Equipment and Furniture | 193,457.14 | 53,186.46 | 140,270.68 |
| 72300 - Materials & Goods | 120,000.00 | 68,810.86 | 51,189.14 |
| 72500 - Supplies  | 0.00 | 4,387.95 | -4,387.95 |
| 72100 - Contractual Service-Companies | 264,285.72 | 34,617.99 | 229,667.73 |
| 72800 - Information Technology Equipment | 32,142.85 | 23,597.81 | 8,545.04 |
| 72400 – Communications & Audio Visual Equipment  | 0.00 | 1,369.25 | -1,369.25 |
| 71200 - International Consultants  | 40,000.00 | 0.00 | 40,000.00 |
| 71300 - Local Consultants | 897,243.73 | 578,850.01 | 318,393.72 |
| 72400 - Rental & Maintenance of Other Equipment | 10,285.71 | 1,974.18 | 8,311.53 |
| 74500 - Miscellaneous Expenses | 3,000.00 | 8,818.40 | -5,818.40 |
| 74700 - Transport, Shipping and Handling | 3,750.00 | 0.00 | 3,750.00 |
|   |  |   |  |
| **Sub-total** | **1,724,628.01** | **818,857.62** | **905,770.39** |

Source: SUCRE Progress Report by year.

|  |
| --- |
| **Project: 00051455** |
| **Project Title: BRA/10/G31 – SUCRE – Sugarcane Renewable Electricity** |
| **Start year: 2015** |
| **End year: 2019** |
| **Implementing Partner: UNDP** |
| **Executing Agency: CTBE/CNPEM** |
| **Revision Type: Substantive Revision 1** |
|  |
| **Project Budget 2017**  |
| **Account** | **Budget US$** | **Executed** | **Balance** |
| 71600 – Travel | 192,335.31 | 95,004.13 | 97,331.19 |
| 72200 - Equipment and Furniture | 50,000.00 | 214,242.61 | -164,242.61 |
| 72300 - Materials & Goods | 45,000.00 | 108,894.89 | -63,894.89 |
| 72500 - Supplies  | 6,350.00 | 0.00 | 6,350.00 |
| 72100 - Contractual Service-Companies | 331,662.50 | 313,618.35 | 18,044.15 |
| 72800 - Information Technology Equipment | 16,078.13 | 14,817.69 | 1,260.44 |
| 72400 – Communication & Audio Visual Equipment  | 3,750.00 | 670.72 | 3,079.28 |
| 71200 - International Consultants  | 0.00 | 0.00 | 0.00 |
| 71300 - Local Consultants | 1,318,790.33 | 1,165,425.77 | 153,364.56 |
| 72400 - Rental & Maintenance of Other Equipment | 0.00 | 0.00 | 0.00 |
| 74100 - Audit Services | 0.00 | 3,069.90 | -3,069.90 |
| 74500 - Miscellaneous Expenses | 1,200.00 | 1,820.65 | -620.65 |
| 74700 - Transport, Shipping and Handling | 0.00 | 0.00 | 0.00 |
|   |  |   |  |
| **Sub-total** | **1,965,166.27** | **1,917,564.70** | **47,601.57** |

Source: SUCRE Progress Report by year.

|  |
| --- |
| **Project: 00051455** |
| **Project Title: BRA/10/G31 – SUCRE – Sugarcane Renewable Electricity** |
| **Start year: 2015** |
| **End year: 2019** |
| **Implementing Partner: UNDP** |
| **Executing Agency: CTBE/CNPEM** |
| **Revision Type: Substantive Revision 1** |
|  |
| **Project Budget 2018** |
|  |  |  |  |
| **Account** | **Budget US$** | **Executed** | **Balance** |
|  |   |   |   |
| 71600 – Travel | 128,490.31 | 57,561.32 | 70,928.99 |
| 72200 - Equipment and Furniture | 136,210.03 | 99,479.29 | 36,730.74 |
| 72300 - Materials & Goods | 109,067.60 | 62,813.97 | 46,253.64 |
| 72500 - Supplies  | 12,307.69 | 2,317.35 | 9,990.34 |
| 72100 - Contractual Service-Companies | 124,692.31 | 106,184.97 | 18,507.34 |
| 72800 - Information Technology Equipment | 75,384.62 | 52,763.02 | 22,621.59 |
| 72400 – Communication & Audio Visual Equipment  | 738.46 | 18.56 | 719.90 |
| 71200 - International Consultants  | 0.00 | 0.00 | 0.00 |
| 71300 - Local Consultants | 1,393,999.87 | 1,169,538.21 | 224,461.66 |
| 72400 - Rental & Maintenance of Other Equipment | 0.00 | 0.00 | 0.00 |
| 74100 - Audit Services | 0.00 | 11,507.11 | -11,507.11 |
| 74500 - Miscellaneous Expenses | 1,753.85 | 3,949.65 | -2,195.80 |
| 74700 - Transport, Shipping and Handling | 23,587.50 | 0.00 | 23,587.50 |
|   |  |   |  |
| **Sub-total** | **2,006,232.24** | **1,566,133.44** | **440,098.80** |

Source: SUCRE Progress Report by year.

|  |  |
| --- | --- |
|  | **Project: 00051455** |
|  | **Project Title: BRA/10/G31 – SUCRE – Sugarcane Renewable Electricity** |
|  | **Start year: 2015** |
|  | **End year: 2019** |
|  | **Implementing Partner: UNDP** |
|  | **Executing Agency: CTBE/CNPEM** |
|  | **Revision Type: Substantive Revision 1** |
|  |  |
|  | **Project Budget 2019/2020** |
|  |  |  |  |
|  | **Account** | **Proposed Budget 2019 - US$** | **Proposed Budget 2020 - US$** |
|  |  |   |   |
|  | 71600 – Travel | 128.696,88 | 24.000,00 |
|  | 72200 - Equipment and Furniture | 0,00 | 0,00 |
|  | 72300 - Materials & Goods | 57.504,16 | 1.298,70 |
|  | 72500 - Supplies  | 7.122,60 | 0,00 |
|  | 72100 - Contractual Service-Companies | 190.984,42 | 107.766,21 |
|  | 72800 - Information Technology Equipment | 0,00 | 0,00 |
|  | 72400 – Communic. & Audio Visual Equipment  | 0,00 | 0,00 |
|  | 71200 - International Consultants  | 8.000,00 | 30.000,00 |
|  | 71300 - Local Consultants | 1.461.575,01 | 911.478,18 |
|  | 72400 - Rental & Maintenance of Other Equipment | 81.389,61 | 0,00 |
|  | 74100 - Audit Services | 6.000,00 | 10.000,00 |
|  | 74500 - Miscellaneous Expenses | 5.777,98 | 4.000,00 |
|  | 74700 - Transport, Shipping and Handling | 9.750,00 | 0,00 |
|  |   |  |   |
|  | **Sub-total** | **1.956.800,67** | **1.088.543,10** |
|  |  |  |  |
|  |  |  |  |

There are many ongoing activities to be carried out in the rest of 2019 and 2020, especially with regard to communication and dialog about changes in the regulatory framework for sales of electric power from sugarcane biomass to the grid. Some funds are still available for these purposes in 2020.

**Partnership Arrangements and Sugarcane Mills Counterpart**

Co-financing partners can be seen below, showing their respective investments. The total amount was US$151,724,137.93, according to CTBE/CNPEM coordination.

Partnership arrangements were very important for the Project implementation and were a central part of the proposal. To find adequate and innovative technologies as well as procedures to collect residues, clean sugarcane trash from the field and transport it to the boilers for processing demanded interactions with sugarcane industries. These partnerships were a central focus of Project execution.

Government institutions, Civil Society Organizations, universities, associations, equipment manufacturers, sugarcane growers, financial institutions, agricultural research institutions like EMBRAPA were some of the partners that requested contacts and partnerships. Arrangements were made and contracts or cooperation agreements were signed.

In 2016, the Project Implementation Review (PIR) explained the partnership established with a professor from the University of Campinas (UNICAMP) and its team. They were hired to work with boiler tests. This partnership is intended to fill a gap capacity in the analysis of biomass combustion, taking advantage of the fact that UNICAMP has a laboratory with necessary equipment installed and operational with qualified technicians and researchers to conduct tests and analysis of combustion of trash and trash/bagasse mixtures. On another front, the impact of different amounts of trash on the ground regarding pests and diseases was evaluated through partnership with the Agronomic Institute of Campinas (IAC). This Institute is a research and development institution affiliated with the São Paulo Agency for Agribusiness Technology of the Secretariat of Agriculture of the State of São Paulo, with headquarters in the city of Campinas.

The Brazilian Sugarcane Industry Union (UNICA) is a non-government organization of the sugarcane producers for ethanol fuel and sugar. UNICA is the largest organization in Brazil representing sugar, ethanol and bioelectricity producers. It was created in 1997, following a consolidation process involving regional organizations in the State of São Paulo after government deregulation of the sugar and ethanol sectors.

UNICA is a very important Project partner. A formal collaboration agreement has been signed to work in the SUCRE Project. Its work is focused in the Regulatory Norms for Brazilian electric power. This association is relevant for achieving the Project goal and its work is focused on leading interactions with government to clarify the potential of the expansion of sugarcane electricity production.

Special partnership arrangements were established with sugarcane mills. As the SUCRE Project is based on case studies, the agreement contracts were established initially with four mills, known as Batch 1, and in a second phase seven more mills were added as Batch 2.

Batch 1 includes the following mills:

* Usina Quatá (Zilor Group)
* Usina da Pedra (Pedra Agroindustrial S/A)
* Usina da Barra (Raizen Group)
* Usina Alta Mogiana

As mentioned, in 2017 a formal cooperation agreement was signed between CTBE and the first three mills and the fourth mill (Alta Mogiana) sent a letter informing its commitment to collaborate with the project, as expressed in PIR/2017.

According this PIR, the mills for Batch 2 were approached and a cooperation agreement was signed with the Santa Izabel mill.

According to PIR/2018, the SUCRE Project worked supporting mills with creation and testing technologies and disseminating new information. The interactions among CTBE and mills are registered, as follows:

* Raizen Group: Da Barra one of the Batch 1 mills and the Dry Cleaning System of Jatai Mill was tested;
* Interactions with Alta Mogiana mill included in Batch 1;
* Quatá mill that is partner in Batch 1 and partner on field trials;
* Santa Izabel mill is included in Batch 2 and partner in industrial tests;
* Granelli mill was partner in industrial tests;
* Caeté mill included in Batch 2 and partner in industrial tests;
* São Luiz de Ourinhos mill included in Batch 2 and partner in industrial tests;
* Ferrari mill included in Batch 2 and partner in industrial tests;
* São José da Estiva mill included in Batch 2 and partner in industrial tests;
* Boa Vista mill included in Batch 2 and partner in industrial tests and in field trials;
* Iracema mill was partner in field trials;
* Cerradinho mill was partner in industrial tests and in field trials;
* Ester mill was partner in field trials;
* Santa Therezinha Group included in Batch 2 and was partner in collection and industrial tests;
* Agrícola BPZ was partner on field trials;
* 4S Farm was partner on field trials;
* HPB Energia was partner in industrial tests regarding boiler performance; and
* Centro de Tecnologia Canavieira (CTC) was partner in adjustments and tests of the chopper.

Thus, partnership arrangements led to commitments of parties involved in the implementation of activities aimed at obtaining the objectives and outcomes established in the PRODOC.

Regarding the installation or complementation of equipment for operation of the sugarcane mills in the generation of electricity, counterpart commitments of the partners and voluntary donations were established, as explained below.

**Sugarcane Mills Counterpart as Project Partners**

The synthesis of the counterpart support of the mills with the SUCRE Project is presented in the table below, which specifies the plants involved in the established partnerships, the sugarcane waste collection and processing system as well as the description of the actions performed, the amount of waste per ton obtained and the total investment per plant.

**Table 6: Partner’s Investment as Co-Financers**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Batch** | **Mill** | **System** | **Description** | **Processed Straw (Ton/Crop)** | **Investment** **(US$)** |
| **Batch 1** | Alta Mogiana | SPF and SLS | Uses the separated straw in the dry cleaning system that is crushed and mixed with the bagasse and then sent for burning in boilers. It processes bales of straw that go through the operations of removal of the "strings", unfolding, sifting and crushing of the straw that is mixed with the bagasse and sent for burning in boilers. Investment SLS and processing of bales. Both systems started operations in 2015. Bagasse and sugarcane straw. Investment in SLS, sieve, straw crusher and SLS R$12.000.000,00. | SLS (40.000 and SPF (30.000) | 3,448,275.86 |
| Pedra | SPF | It processes bales of straw that go through the operations of removal of the "strings", unfolding, sifting and crushing of the straw that is mixed with the bagasse and sent for burning in boilers. Installed Power 70 MW (beginning in 2010 and completed in 2012). It sells about 24 MW. Co-generation investment was R$238,000,000. Investment in the system of processing bales about R$14,000,000. | 50.000 | 3,448,275.86 |
| Quatá | Forage | Collect straw in the fodder system. | 70.000 |  |
| Barra | SLS | Uses the separated straw in the dry cleaning system that is crushed, sifted, mixed with bagasse and sent to boilers. Investment in SLS, sieves and crushers R$24,000,000.00. Installed in 2013 and start of operation in 2014. | 80.000 | 6,896,551.72 |
| Comple-mentary**Batch 2** | Santa Izabel | SLS-ABatch 1 | Uses the separated straw in the dry (alternative) cleaning system that is crushed, sieved, mixed with the bagasse and sent to boilers. Construction in 2015, start of operation in 2016. Stage 2 (fans and suit of extraction /milling of straw). Start of implementation 2017 expected completion in 2018.   | 80.000 | 1,436,781.61 |
| Ferrari | SPF | Processes bales of straw that go through the operations of removal of the "strings", unfolding, sifting and crushing of the straw that is mixed with the bagasse and sent for burning in boilers. | 90.000 | 4,022,988.51 |
| São Luiz | SLS- Straw washing | Uses the separated straw in the dry cleaning system that is washed, drained and mixed to the bagasse in the last suit of the mill and is sent for burning in boilers. It is investing in a new boiler (200 ton/h, 67 Bar, 480 ° C) and turbo generators for 37 MW. Boiler and turbo generators installed in 2018. | 60.000 | 21,551,724.10 |
| Granelli | SLS- Straw washing | Uses the separated straw in the dry cleaning system that is washed, drained and mixed to the bagasse in the last suit of the mill and is sent for firing in boilers. The SLS started operation in 2012. It is making investment in a new boiler (120 ton/h, 42 Bar), start of construction in 2016, went into operation in 2018. | 15.000 | 4,310,344.83 |
| Caeté/GranBio | SPF | Processes bales of straw that go through the operations of removal of the strings, unpacking, sifting and grinding of the straw that is mixed with the bagasse and sent for firing in a fluidized bed boiler (67 Bar, 525°C, 200 ton steam/h). Bagasse and cane straw. | 80.000 | 22,988,505.70 |
| Cerradinho |  | Fluid bed biomass boiler (67 Bar, 520°C, 400 ton steam/h) and two turbo-generators of 45 MW. Generation capacity went from 70 MW to 160 MW. Export 357 GWh. Bagasse, cane straw and grains and eucalyptus. Started in February 2015 and went into operation in April 2017. | - | 71,839,080.50 |
| São José da Estiva | SLS- Straw washing | Uses the separated straw in the dry cleaning system which is washed, drained in the last suit of the milldrained in an individual milling suit and mixed with the bagasse and sent to boilers for firing. Investment in SLS, plaha washing system and straw drainage suit R$12,000,000.00. | 35.000 | 3,448,275.86 |
| Boa Vista | SLS | Uses the separated straw in the dry cleaning system that is crushed, sifted, mixed with bagasse and sent to the boiler for firing. Investment in SLS, Sieve and crusher R$14,000,000.00. Start-up in 2015 and started operation in 2016. | 90.000 | 4,022,988.51 |
| Santa Therezinha | SLS | Will invest in a system of dry cleaning, crusher (?) and sieve (?). The separated straw in the SLS will be mixed with the bagasse and sent to boilers. Estimated investment in SLS, sieve and crusher of R$13,000,000.00. In deployment. | 38.400 | 3,735,632.18 |
| **Totals** | **758.400** | **151,724,137.93** |

Source: Partnerships Investments, CTBE/SUCRE Report.

**Counterpart of the CTBE/UNDP**

In addition to the attributions and actions developed by the counterparts of the executing and implementing agencies of the SUCRE Project already mentioned, the cooperation agreements established between CTBE/UNDP and the partners are part of a document that specifies the start and end dates of the contract and the objectives to be achieved by the actions developed. The documents were prepared by the CTBE/UNDP partnership and the counterpart arrangements involve experiments with the application of innovative technologies adapted to the needs of sugarcane waste processing for the gradual increase in the generation of electric energy to be commercialized and delivered to the national electricity grid. The synthesis of the experiments and results obtained are included in the following items as part of this Midterm evaluation report. The following table presents the data described above:

**Table 7: Cooperation Agreements between**

**Sugarcane Mills and CTBE/UNDP**

|  |
| --- |
| **Sugarcane Renewable Electricity (SUCRE) Project – BRA/10/G31****Cooperation Agreements between Sugarcane Mills and CTBE** |
| **Partnership****Institution** | **Agreement Start** | **Agreement End** | **Agreement Objective** |
| UNDP | April 2015 | December 2019 | The global objective is to catalyze the establishment of a commercial market to supply sugarcane-based electricity to the Brazilian grid to replace electricity from fossil fuel generated to meet the increasing demand for electric energy in Brazil |
| ÚNICA | April 2016 | April 2020 | The overall objective of the Project is to catalyze the creation of a commercial market for the supply of sugarcane-based electricity to the Brazilian energy grid and thus to displace part of the need for fossil fuels that would otherwise be consumed to generate electricity and meet growing electricity needs. |
| QUATÁ | November 2016 | May 2019 | The main objective is to reduce greenhouse gas emissions by significantly increasing the exportable power generation potential of the plants, using straw as fuel as a complement to bagasse fuel. |
| ZILOR | November 2016 | May 2019 | The main objective is to reduce greenhouse gas emissions by significantly increasing the potential for exportable electric power generation potential of the plants, using straw as a complement to bagasse fuel. |
| DEDINI | September2016 | September 2021 | The objective of this cooperation is to use the experience of Dedini as a major boiler manufacturer in evaluating the operation of existing boilers for bagasse and straw biomass, thus allowing greater use of straw in the generation of electric energy and the increase in the exported surplus the by the Plant. Working together will also identify and eliminate technical and regulatory barriers and disseminate the information obtained. |
| Pedra AgroindustrialS/A | September2016 | September 2021 | The objective of this project is to carry out actions based on the identification and elimination of technical, regulatory and information dissemination barriers, thus allowing greater utilization of straw in the generation of electric energy and increase in the surplus exported to the network by the Plant. |
| Unidade de Mendonça S/A | September2016 | September 2021 | The main objective is to reduce greenhouse gas emissions by significantly increasing the exportable power generation potential of the plants, using straw as fuel as a complement to bagasse. To achieve this, it is necessary that this increase in the generation of electricity, besides being environmentally advantageous, also be commercially viable. |

Source: CTBE/SUCRE Report.

In conclusion, the Evaluator of this MTR affirms that the products and results have been obtained with quality and efficiency and the coordination and execution of the Project have sought the effective participation of partners and stakeholders. The actions result from the operational commitment of the project executing agency team and the partnership established with the UNDP/GEF implementing agency and with the involvement of the accredited partners to benefit from the results obtained. This coordination and execution of the parties involved were considered: **Highly Satisfactory (6 pts).**

 **3.3.4 Project-level Monitoring and Evaluation Systems**

As foreseen in the new PRODOC, monitoring and evaluation have been carried out directly by UNDP, with coordination by CTBE. They provide the necessary information, involve the key partners and are aligned with the national system. They use existing information and are efficient and cost-effective. The resources allocated have been sufficient.

Monitoring has consisted of systematically monitoring the implementation of SUCRE Project activities to achieve the proposed results, in accordance with the objectives of the Project, as well as through the preparation of periodic reports in accordance with UNDP standards. Reporting data has been obtained through interaction and contacts with partners involved in the Project, meetings and field visits that have been included in the AWP.

In addition, monitoring and evaluation of the implementation of the Project have been systematically carried out through the progress reports submitted to UNDP/ABC, in accordance with the minutes of tripartite meetings, and regular reporting to financial transfers every six months.

UNDP and CNPEM/CTBE have worked together to provide information and technical-financial data that should compose the Midterm Evaluation report, reflecting the ongoing monitoring and evaluation activities of the components of Project BRA/10/G31 and results, in order to achieve the objectives within the deadlines proposed in the annual work plans.

The guarantee of compliance with the Project’s products and results also depends on compliance with the proposed indicators, baseline data and final objectives to be achieved in an interrelated and satisfactory manner in the Project implementation.

The management of information and its dissemination to reach the goals of awareness of the relevance of producing and managing renewable energy from the processing of sugarcane residues among governmental agencies, interest groups, academia, non-governmental organizations and the population has been carried out by the SUCRE project team. This is confirmed in the progress reports where the work done with the partners and stakeholders and the results obtained are described.

Data collection for information management planning has also involved the project’s partnerships and the commitment of the team to the objectives of reaching the target groups and to replication of the activities and results of the SUCRE Project.

Thus, CTBE/UNDP, through its coordination and the work of its team, has systematized and recorded the data and information to obtain the outputs and outcomes of the Project. The collaboration of the various actors involved in the implementation of the Project has ensured the monitoring and periodic evaluation of the activities proposed by Project BRA/10/G31.

In conclusion, according to the MTR evaluator, pursuing the proposed and achieved outcomes aimed at achieving the objectives of the Project and obtaining the outputs proposed by PRODOC and according to the SMART criteria, the actions of the Project have been:

* consistent with the specific nature of the issues involved and presented in language accessible to the groups that make up the Project partnerships, with transparency and precision;
* planned according to established and relevant indicators to comply with the commitments established by the country to reduce greenhouse gas emissions, as established by the GEF for approval of its projects;
* compatible with the capacity of the partners involved in Project implementation;
* relevant at the local, national and international levels, contributing to the priorities established by Brazil in the Conferences of the Parties; and
* achieved in a way that results are not an end in themselves, but the basis for continuous improvement of information, data and other findings, aimed at reducing harmful impacts on the environment and the replication of actions at the national level and in other countries.

 **3.3.5 Stakeholder Engagement**

According to the MTR, the Project has developed and leveraged the necessary and appropriate partnerships with direct and tangential stakeholders. Local and national government stakeholders support the objectives of the Project. They continue to have an active role in Project decision-making that supports efficient and effective implementation. Stakeholder involvement has contributed to progress toward achievement of Project objective. At the same time, more public awareness would be beneficial.

The roles of the various stakeholders are as follows:

* **The National Center for Research in Energy and Materials (CNPEM)** is a social organization supervised by the Ministry of Science, Technology, Innovation and Communications (MCTIC). Located in Campinas-São Paulo, it has four laboratories worldwide references and opens to the scientific and business community. The National Synchrotron Light Laboratory (LNLS) operates the only Synchrotron light source in Latin America and is currently building Sirius, the fourth-generation Brazilian accelerator for analysis of the most diverse types of materials, both organic and inorganic; the National Laboratory of Biosciences (LNBio) develops research in areas bordering Bioscience, focusing on biotechnology and drugs; and the National Nanotechnology Laboratory (LNNano) carries out research with advanced materials, with great economic potential for the country; and the National Laboratory of Bioethanol Science and Technology (CTBE) investigates new technologies for the production of cellulosic ethanol. The four laboratories also have their own research projects and participate in the transversal research agenda coordinated by CNPEM, which articulates scientific facilities and competences around strategic themes. The CNPEM integrate singular competences and is recognized as a national research center developing creative solutions in the areas of energy, materials and biosciences.
* The Project is being carried out by the Brazilian Bioethanol Science and Technology Laboratory (CTBE), which is part of the CNPEM, with UNDP as the GEF implementing agency. CTBE undertakes high level research and develops technology in the area of biofuels, and is well poised to address the global challenges of the bio-economy. CTBE coordinates the Project and designate a Technical Coordination Team (TCT) composed by a National Project Director, the Assistant National Project Director, a Technical Manager, a Financial Manager, an Environmental Manager, a Legal Manager and a Dissemination Manager.
* **Centro de Tecnologia Canavieira** (Sugarcane Research Center or CTC) originally would have been responsible for Project execution. However, as CTC became a private company it was therefore ineligible to be the executing agency for SUCRE Project. CTBE/CNPEM became the executing agency. CTC is the largest sugarcane technology center in the world. Its headquarters is located in Piracicaba, São Paulo, in one of the most prosperous agribusiness regions in Brazil. CTC was founded in 1969 to attend the technological needs of Copersucar sugarcane producers. In 2004, it started offering innovation and technology also to sugarcane producers and processors associates all over Brazil. CTC became an company in 2011 and since then Copersucar and Raizen are its majority owners. It has more than 130 associated members, among mills and associations of sugarcane suppliers, representing thousands of farmers and approximately 60% of the sugarcane produced in Brazil. The Sugarcane Breeding Program is one of the most important of the CTC projects because of its global effects on competitiveness of Brazilian sugarcane producers. There are also other important CTC research projects in areas such as agricultural and industrial production process. In June 2017, it has been granted the commercial use of genetically modified sugarcane. In May 2018 the company announced expansion to North America with a research center in the St. Louis, Missouri area of the central United States.
* **União da Indústria da Cana de Açúcar (UNICA)** works to promote new business opportunities for the sugarcane industries, including helping to address legal and institutional barriers. To assist UNICA’s efforts, CTC provides technical information and analysis on an ongoing basis.
* **Ministério da Ciência, Tecnologia, Inovações e Comunicações (MCTIC) and Financiadora de Estudos e Projetos (FINEP)** are government agencies that support development and demonstration of technologies to reduce and eliminate perceived risks so that new competitive industries can develop and flourish in Brazil.
* **Equipment manufacturers** will benefit from technology development assistance and the creation of a new market for sales of their commercial equipment.
* **Sugarcane mills providing co-financing:** the SUCRE project will help overcome risks of increasing electricity export to the grid using trash; profitability of the sugarcane sector should increase with successful projects.
* **Other sugarcane mills:** overcome risks of increasing electricity export to the grid using trash; increase profitability with successful projects, making viable a new energy feedstock for sugarcane processors (e.g., if ligno-cellulose conversion to ethanol is pursued, it will need additional biomass).
* **Sugarcane growers** will benefit from larger revenues from supply of trash to mills. If the SUCRE project is successful, this would provide incentive for speeding up conversion to green cane harvesting.
* **Electricity supply sector (utilities):** increase biomass power supplied to grid to help avoid future shortages; reduced GHG emission associated with the grid.
* **Federal, state and municipal governments:** promote vitality of sugarcane industry, increase electricity supply to country, reduce greenhouse gas emissions, catalyze more green cane harvesting (less air pollution from burning), and promote regional employment and economic development.
* **Financial institutions and banks:** with a successful project, techno-economic risk of trash utilization for export electricity production will be reduced, enabling routine lending for future projects.
* **Industries/businesses related to the sugarcane and energy industries:** future market for commercial equipment.
* **Environmental entities and related institutions:** the use of trash will contribute to decrease the amount of CO2 that is thrown in the atmosphere, as it will substitute for fossil fuel and will also be an incentive to avoid pre-harvest burning of the cane.
* **Carbon market entities and companies:** a larger number of projects will be available for the CDM market.
* **Agricultural research institutions** like EMBRAPA, Polo National de Biocombustíveis and other research organizations: open new areas for research and development.

 **3.3.6 Reporting**

As can be seen in the section on Management Arrangements (3.3.1), the Project Management reported on adaptive management changes and shared them with the Project Board. The Project Team and partners undertook and fulfilled GEF reporting requirements. The lessons learned from the adaptive management process were documented, shared with key partners and internalized by partners. The key issue is with regard to Project extension.

 **3.3.7 Communication**

Internal Project communication with stakeholders is regular and effective. No key stakeholders are left out. There is constant feedback. Communication contributes to awareness of the Project outcomes and activities and investment in the sustainability of Project results.

External Project communication is carried out through proper means to express the progress and the intended impact to its public. In addition to many academic articles needed for exchange about technologies as well as seminars, there is a bimonthly newsletter. There is web presence on the site <https://www.pages.cnpem.br/sucre>. There was also wide coverage in the press, as can be seen in the list of references at the end of this report. It would be important to reach out farther to disseminate the groundbreaking results.

For reporting, there follows a half-page paragraph that summarizes the Project’s progress towards results in terms of contribution to sustainable development benefits, as well as global environmental benefits:

**GENERATING ELECTRICITY FROM SUGARCANE RESIDUES**

The main objective of the Sugarcane Renewable Electricity (SUCRE) project, funded by the Global Environment Facility (GEF) and managed in partnership with the United Nations Development Program (UNDP), is to overcome the technological challenges in the field and in the sugarcane industry in order to expand cogeneration of electricity from crop residues with low emission of greenhouse gases (GHG) that contribute to global warming. The project is executed by the National Bioethanol Science and Technology Laboratory (CTBE), which is part of the National Energy and Materials Research Center (CNPEM). The team and the partners have made important progress identifying and solving problems that limit large-scale generation of electricity through greater use of the sugarcane straw left over during the harvest. During the five years of execution (2015-2019), the total investment is about US$67.5 million, of which US$55.8 million is investments by the plants for installation of dry cleaning stations, renovation or purchase of boilers, turbo-generators, balers and other equipment. The additional power generated helped avoid blackouts when hydroelectric power in the grid ran short because of reductions in rainfall. The technology that makes significant contributions to sustainable development and global environmental benefits is being widely disseminated.

**3.4 Sustainability**

Sustainability can be defined as the likelihood of continuous benefits after project completion. This section includes analysis of financial, socio-economic, institutional framework/ governance and environmental risks to sustainability.

 **3.4.1 Financial Risks to Sustainability**

The BRA/10/G31 Project has provided financial, institutional and governance conditions to continue work during and after its implementation. Considering the period after the execution of this Project, the MTR foresees the continuity of the actions through continuous improvement of the innovative technologies applied for the processing of sugarcane straw and the continuous and firm dialog with governmental institutions for the change in the regulatory barriers that affect the sector and that should lead to the sustainability of the Project.

Specifically, the MTR evaluated the sustainability of Project BRA/10/G31 considering the risks that could affect the continuation of its results, including financial, socio-economic, environmental and institutional/governmental risks.

The financial risks to sustainability were minimized by the engagement of partners that modified their plants for generation using sugarcane trash and the growing demand for electricity in general and from renewable resources in particular.

With regard to Atlas risk and management and mitigation measures, the socio-economic risks to sustainability are minimal, given the stability of the industry and the fact that temporary labor for cutting cane has been replaced by mechanization.

 **3.4.2 Socio-Economic Risks to Sustainability**

Temporary seasonal work of men migrants coming to harvest cane under stressful working conditions (known as “*bóia-frias*”, meaning “cold lunch”) has been largely replaced by mechanization, i.e. development of technology. On the one hand, working conditions and security have improved and risks have been reduced. On the other, there are fewer opportunities for poor urban families in the region and family farmers in other parts of Brazil to have access to monetary income.

Gender issues, which were not taken into consideration in the original design of the Project, are relevant among the researchers and in the project execution team, where there is balance, with practically equal participation of women. Of the 59 people directly involved in project execution (professional staff, researchers, specialists, analysts and students), 29 are women, i.e. 49%. The positions they hold include the project coordinator, financial coordinator, human resources director, specialists and researchers.

On the other hand, there is little balance among private sector partners in agribusiness, where men have always prevailed. As for labor, manual sugarcane harvesting has traditionally been only for men. Nowadays, mechanized harvesting involves a smaller number of men, while there are women working in the plants.

 **3.4.3 Institutional Framework and Governance Risks to Sustainability**

With regard to the institutional framework and government risks to sustainability, the main risk identified concerns the regulatory barriers to commercialization of electricity from institutions to be promoted from 2019 onwards is expected to open doors for the sustainability of the Project.

The Project can guarantee the sustainability of the actions of the institutions involved through initiatives to finance carbon credits, as mentioned in the PRODOC. Agreements among public authorities and manufacturers, importers and other entrepreneurs in the sector may be established in order to keep equipment updated and maintained and systematically acquire knowledge, providing sustainability conditions for the Project.

 **3.4.4 Environmental Risks to Sustainability**

Environmental risks to sustainability have to do with shortages of rainfall because of dry spells or longer dry seasons and loss of soil fertility due to removal of biomass from the fields. Scarcity of water can affect growth, but will not kill the cane. Measures are being taken to leave enough biomass in the fields.

**Sustainability Classification**

The evaluator of this MTR has identified that the efforts made to improve regulations, especially in relation to bioelectricity prices produced by the processing of sugarcane residues, may have responses that strengthen the sector and bring economic, social and environmental sustainability to the production of bioelectricity as a whole and specifically for the sector. The sustainability of the results is demonstrated by the work with the sectors and the evaluation of the sustainability of the actions of the Project is therefore **(4 pts)**.

**4 Conclusions and Recommendations**

 **4.1 Conclusions and Lessons Learned**

In addition to conclusions, this section includes and the lessons learned so far in the SUCRE Project.

**4.1.1 Conclusions**

According to this MTR, implementation of the SUCRE Project has been conducted satisfactorily. Among the success factors and best practices, the key points were the establishment of public and private sector partnerships as the principal means of project implementation, mobilizing multiple sources of cash and in-kind co-financing. Various studies and experiments, be they theoretical, in laboratories or in the field, were relevant. This success in achieving outputs and outcomes to obtain defined objectives occurred both because of setting up a coordination unit for the preparation of experiments and defining technologies to offer to the mills and because of the involvement of experts from various public and private sectors. Project finalization and sustainability still require efforts to achieve some products and results, mainly related to dissemination and replication activities.

The Project successfully changed with success many procedures and technologies and replaced them with more appropriate innovations. The Project team organized technical and economic information that was dispersed, disorganized or incomplete. This required research and experiments regarding quality of the straw and possible impacts on the environment and the boilers. Partners such as mills, equipment and boiler manufacturers as well as associations were involved in working more carefully and reliably with sugarcane straw for electricity generation in order to find innovations to overcome the technological barriers that appeared. In 2017, the mills that use biomass as a source of energy produced 25,482 Gwh for the national grid. The four partners from Batch 1 are generating and exporting to the grid 36% more than the PRODOC target, which was 180 MWh per year by three mills, according to SUCRE reports prepared to MTR evaluation.

The evaluation of the activities already carried out by the Project, with the complete engagement of the team and of the experts in related areas, shows that more than 70 agronomic, industrial and straw transport experiments have been carried out and are described in the progress reports. Many laboratory analyses were performed. All of these activities were carried out so as to contribute to the main target of this project, namely the 14 partner plants of the Project, located in the state of São Paulo and the region.

The challenges faced by the Project were the need for technological advances in the collection and conversion of sugarcane straw to reduce equipment maintenance costs, besides reducing costs caused by inefficiency in the burning and incrustations and deposits of impurities in the boilers. The challenges were mainly related to the high content of mineral impurities, the low efficiency of Dry Cleaning Systems (SLS) to remove contaminants found in straw and in the soil. The solutions were part of the results-oriented activities foreseen in the project document and were found in an efficient way.

Other benefits of the activities developed have to do with the agronomic impacts of straw removal. The analyses carried out by the Project brought a better understanding of the impacts on the soil and on the water resources used in straw processing.

Reducing greenhouse gas emissions, a global priority of GEF, was a major concern to be addressed. The Project team, assisted by hired experts, identified emissions due to the production of ethanol. The avoided emissions for 2017 were 10.32 gtCO2eq. It was found that straw increases the N2O emissions from fertilizers and vinasse. Although there are still few studies on this subject, the Project proposes to do research on the problem and if it cannot present a solution at the moment, it has a proposal to minimize the problem.

The evaluator identified valuable information contained in the project progress reports and in published documents that contained inputs from experiments, studies and analyses. The Project team also identified that the ethanol emission balance studies carried out in Brazil using the "default" value proposed by the IPCC need more studies. It is the intention of the team to carry out studies with the collection of data and information to calculate the actual values.

Other studies on the potential of straw use were also carried out by the Project team, including the establishment of methodology for mapping and guidance of good practices for the removal of straw and the existence of pests and diseases that may impact productivity.

All these activities were key for the successful implementation of the Project and its potential for application in other regions and countries. This is due both to the work and the composition of the execution team and the commitment of the Project coordination unit. In addition, the involvement of experts contracted by the Project and mainly its work to evaluate the procedures applied by the partner plants has led to greater efficiency in the production of energy from the processing of sugarcane residues. Obtaining renewable alternative energy that may bring economic and social benefits is the way to be followed in the search for efficient results. The results of the evaluations and analyzes carried out by the Project were important inputs for decisions to purchase equipment and materials to provide the sugarcane mills with greater possibility of production growth.

All the activities developed and the results found and transmitted to the partners are expressed and contained in the progress reports of the Project. Many are also contained in academic articles, as well as 19 bi-monthly newsletters published and disseminated not only to the target public of the Project, but also to the various stakeholders involved (<https://pages.cnpem.br/sucre/newsletter-sucre/>).

The evaluation also identified the dissemination of new proposals for the collection and grinding of straw as part of the processing required for the generation of electric energy. Thus, new straw collection procedures were transmitted as lessons learned by the Project and led to reduced transportation costs, such as straw crushing in the field instead of the plant. All these established procedures were transmitted in seminars or written documents, bringing significant economic, social and environmental benefits.

In conclusion, the MTR evaluator can attest that the Project has been developed efficiently and that the issues researched and analyzed are of paramount relevance to local, regional and national development. In addition, the Project's results have contributed globally to reducing the impacts of climate change and met GEF objectives. The review of the Project activities and the results obtained was aimed at viewing the importance of the actions of the Project, drawing lessons learned and proposing recommendations.

**4.1.2 Lessons Learned**

Some lessons can be drawn from the experiments, studies and analyses carried out to date. Among them, the Evaluator highlights the ones that are explained below.

- The lessons learned from the results obtained from the search for technologies to collect sugarcane waste for electricity generation and to bring this energy to the market and the results of studies and analyses of the economic viability of the commercialization of this energy from sugarcane biomass and also the results obtained from studies and analyses on the impacts of the collection of sugarcane residues on the sugarcane crop and harvest cycle, on the environment and on production sustainability.

These lessons were fundamental to respond to the methodological issues and the efforts of dissemination of the knowledge acquired by the technical-economic and environmental evaluations; modeling with data validated by partners; by the ability of customization; and by the scenarios obtained and with the formulation of proposals for the expansion of straw collection for the production of bioelectricity.

- Lessons learned from research methodologies in the field and industry, providing an overview of the issues involved the need to raise awareness of the importance of using appropriate and innovative technologies and lessons learned from predicting environmental and socioeconomic impacts.

- The dissemination of the lessons learned led some plants to participate effectively and become interested in information about:

* costs of straw collection;
* potential for additional electricity generation;
* additional revenue and impact on co-products;
* interest in the proposal of industrial equipment layout and investment estimation;
* agro-industrial costs of straw; minimum selling price of electricity from straw; and
* interest in surveying the potential for greenhouse gas emissions compared to non-collection and electricity from other sources.

- Lessons learned also led to the construction of tools such as the calculator offered for use by the partners for preliminary evaluation of the use of straw in the generation of bioelectricity. This tool also reflects the importance given to the project's sustainability, since it can be used after the end of activities, providing integrated modeling.

- The contributions or inputs resulting from the Project actions also led to lessons related to the mitigation of emissions and identifying that emission reduction would be 11% with the production of bioelectricity, considering the total emissions in Brazil.

- Other lessons are related to the results of research that showed the effects of deforestation for the expansion of sugarcane and regarding the availability of water resources. For water, the results showed that the sugarcane has a positive regulating effect of the flow as compared to annual crops and pasture. According to data collected by the Project team, there was an increase of up to 10% in the actual water availability of the watersheds, in response to the occupation of up to 40% of the area.

- The MTR also emphasizes the results of studies and research that generated lessons learned about some social impacts of sugarcane straw collection, going beyond what was originally planned. These lessons came from the Social Assessment of the Life Cycle (ACV-S) added to the Input-Output Analysis using social impact indicators compared to other renewable or non-renewable energy sources, according to a report prepared by the Project team.

The lessons learned central to the success of the SUCRE Project came from the suggestions and contributions made in the evaluation reports of energy sector regulatory milestones. The results produced inputs for the preparation of the Bioelectricity Booklet that has as its content: modalities of sale of renewable electricity; interconnection to the national electricity grid; preparation of the letter of suggestions on marketing and standards; inputs for holding meetings with the Ministry of Mines and Energy (MME) and other institutions; and ways to strengthen the partnership with UNICA.

**4.2 Recommendations**

The recommendations made by this MTR of the SUCRE Project are as follows:

* Extend the expiration date of the Project until December 31, 2020, as justified in this MTR, which identifies reasons for delay in agreement with the proposed work schedule presented by the National Project Director (NPD) and approved by the Project Advisory Committee (PAC) and sent to GEF/UNDP for approval and then to ABC, with attention to exit strategies involving other actors.
* Consider the suggestion made by this MTR and UNDP Program Officer to include in the PAC subgroups of discussion on the Project related topics, such as bioelectricity and renewable energy.
* Conduct revision of the regulatory framework of the national electricity sector including the sector of bioelectricity and other public policies and hold discussions through seminars or workshops, ensuring strong contributions by the involvement of the Project partners and stakeholders.
* Plan for and implement increased communication through various media and events in Brazil and abroad of academic and applied research on the conditions under which sugarcane residues are removed for electricity generation, including more data and information on the scenario in which biomass removal may impair soil fertility and influence soil erosion.
* Increase efforts to involve other ministries, such as Mines and Energy (MME), Agriculture (MAPA) and Environment (MMA).
* Clarify that the sugarcane agriculture in the area covered by the Project is not a direct cause of deforestation, since it is carried out in areas already deforested and used for pasture or crops.
* Increase efforts to replicate the sustainability and continuity of the activities developed by the Project in other areas or regions of Brazil where there are sugarcane plantations and processing plants.
* Prepare a plan to disseminate the information obtained through the execution of the Project, as well as on successes and challenges faced in the consolidation of alternative renewable energy generation.
* Promote and participate national and international seminars for the broader dissemination of the Project experiences.
* Prepare plan for replication of the activities developed by the Project, taking into account local specificities and presenting the successes and challenges facing the sector.

The corrective actions, follow-up, future directions and best and worst practices are as follows:

**Corrective actions for the design, implementation, monitoring and evaluation of the project**

This Project is near conclusion, but there is need for greater attention to dealing with the regulatory barriers to the commercialization of electricity generated by sugarcane mills. Include in the Project design more effective means of promoting dialog with government institutions, involving the project team, UNICA, mills and ministries of Agriculture, Livestock and Food Supply (MAPA), Mines and Energy (MME) and Science, Technology, Innovation and Communication (MCTIC) and their agencies like EPE and ANEEL, among other stakeholders.

**Actions to follow up or reinforce initial benefits from the project**

From now on, wide dissemination of the results to decision-makers and the public will reinforce initial benefits from the Project. Additional benefits can be achieved by making full use of the data collected in the field and in industrial experiments.

**Proposals for future directions underlining main objectives**

Future directions could include continuation and deepening of the engagement of other institutions related to the sector of renewable energy, as mentioned above, as well other private organizations and local governments, especially those with strong activities on environment and alternative energy at local, state and regional levels.

**Best and worst practices in addressing issues relating to performance and success**

The best practices were involving contributions by partners and stakeholders, including universities and students, who then continue working on the subject in years to come. No worst practices were found.

 **4.3 Ratings**

The UNDP evaluation policy stipulates that ratings should be assigned to the relevance, effectiveness, efficiency and quality of the activities implemented by the Project and the monitoring and evaluation system. Table 8 lists all ratings provided by the MTR Evaluator, based on the considerations already mentioned.

**Table 9: MTR Rating & Achievement Summary**

|  |
| --- |
| Measure MTR Rating Achievement Description  |
| Project Strategy | N/A |  |
| Progress Towards Results | ObjectiveAchievement Rating: (rate 6 pt. scale) **5 (S)** | The objective is close to being fully achieved and can still achieve some wider dissemination, capacity building and replication as well as change in the regulatory framework for marketing of low GHG electricity. |
| Outcome 1Achievement Rating: (rate 6pt.scale)**6 (HS)** | Technology has been made operational for commercial use. |
| Outcome 2Achievement Rating: (rate 6pt.scale)**6 (HS)** | Economic feasibility for commercial use of sugarcane energy has been demonstrated. |
| Outcome 3Achievement Rating: (rate 6pt.scale)**6 (HS)** | Effects on the cultivation and harvesting cycle have been addressed to ensure environmental integrity and long-term sustainability. |
| Outcome 4Achievement Rating: (rate 6pt.scale)**6 (HS)** | Sugarcane trash is being utilized across the sugarcane sector with private investment taking benefit from lessons learned. |
| Outcome 5Achievement Rating: (rate 6 pt. scale)**5 (S)** | An adequate legal and regulatory framework is not yet in place to promote the sustainable use of sugarcane trash for electricity generation and sales to the grid. |
| Outcome 6Achievement Rating: (rate 6pt.scale)**6 (HS)** | Project monitoring, learning, adaptive feedback and evaluation are being carried out. |
| Project Implementation & Adaptive Management | (rate 6 pt. scale)**6 (HS)** | Project implementation and adaptive management has been highly satisfactory, but a time extension is needed. |
| Sustainability | (rate 4 pt. scale)**4 (L)** | Project sustainability is likely because of wide-reaching private sector partnerships. |

Source: Ratings established according to: Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects.

According to the Evaluator, the Project rating as a whole is **Highly** **Satisfactory (6 pts)**, which means that the Project has minor shortcomings and delays in implementation, but they are recoverable and justified by the delay starting execution and the complexity of the actions leading to the Project results.

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**MTR Report of the SUCRE/BRA/10/G31 Project**

**Annexes**

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**5.1 TOR**

**UNDP-GEF Midterm Review Terms of Reference**

**Standard Template 1: Formatted for attachment to** [**UNDP Procurement Website**](http://procurement-notices.undp.org/)

1. **INTRODUCTION**

This is the Terms of Reference (ToR) for the UNDP-GEF Midterm Review (MTR) of the *full*-sized project titled *Sugarcane Renewable Electricity* (PIMS3515) implemented through the UNDP/*BRA-CTBE/CNPEM*, which is to be undertaken in 2019. The project started on the *April 20, 2015* and is in its *fourth* year of implementation. In line with the UNDP-GEF Guidance on MTRs, this MTR process was initiated before the submission of the second Project Implementation Review (PIR). This ToR sets out the expectations for this MTR. The MTR process must follow the guidance outlined in the document *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects*, as per attachment.

**2. PROJECT BACKGROUND INFORMATION**

The success of the Brazilian sugarcane-ethanol program is now well established, both in terms of being commercially competitive today without subsidy and in terms of achieving significant ongoing reductions in greenhouse gas emissions relative to petroleum fuel use. The project described here seeks to help launch a similar commercial and environmental success story with sugarcane-biomass electricity generation in Brazil. The proposed project is globally significant because over 80 countries grow sugarcane, and Brazil is viewed internationally as a leader in technological innovation and competitiveness in the sugarcane processing industries. Thus, success in Brazil would likely catalyze similar efforts in other countries. As biomass-based electricity production is already familiar in the Brazilian sugarcane processing industries, where generated electricity meets onsite process requirements, the hurdles to commercial success in electricity are much less daunting than at the same stage of development of the sugarcane-ethanol program.

The overall objective of the proposed project is to catalyze the establishment of a commercial market for sugarcane-based electricity supply to the Brazilian grid, to displace fossil-fuel electricity that would otherwise need to be generated to meet growing electricity demands in Brazil. The GEF has helped lay the foundation for a cane-power industry in Brazil by sponsoring an earlier project (Biomass power Generation – GEF ID 338) that was largely a technology development and capacity building effort. The SUGARCANE RENEWABLE ELECTRICITY (SUCRE) project will build on this earlier effort to catalyze the transformation of the sugarcane industry in Brazil into one for which supply to the grid of renewable electricity from sugarcane biomass becomes a significant and core aspect of their business, alongside sugar and ethanol production.

The project seeks to overcome the technological challenges in the field and in the industry in order to make possible a greater use of the sugarcane straw in the cogeneration. For this, the team works to identify and solve the problems that prevent the partner mills from generating electricity in a complete and systematic way. The SUCRE team works on seven work fronts (Outcomes) that pursue the following results: Outcome 1: Operation of the technology for collecting and converting sugarcane straw into electricity for commercial use; Outcome 2: Demonstration of the economic viability of sugarcane straw collection for the generation of electricity in mills; Outcome 3: Evaluation of the effects of sugarcane straw collection on the crop and harvest cycle, in order to guarantee environmental integrity and long-term sustainability; Outcome 4: Broad dissemination of the environmental and economic guidelines for the use of sugarcane straw throughout the sugar and ethanol industry, according to the lessons learned; Outcome 5: Formulation and/or adaptation of the legal and regulatory framework to promote the sustainable use of sugarcane straw for the production of electricity and sale to the grid; Outcome 6: Project monitoring, learning, adaptive management and evaluation; and Outcome 7: Project management.

Sucre total budget is around 68 million dollars, allocated among GEF (7.8 mi US$), CTBE (3.75 mi US$), the Brazilian Sugarcane Industry Association – UNICA (0.1 mi US$) and the partner mills (56 mi US$). UNICA has contributing as partner in the project conducting activities and actions related to Outcome 5. Moreover, mills are important partners in project implementation and Sucre are conducting field trials and industry tests in fourteen mills located in Centre-South and Northeast Brazil. As an engagement initiative, boilers and other equipment manufacturers are following industry tests together with the Project Team. Other stakeholders are being committed to the project through workshops and meetings frequently conducted by the Project Team.

**3. OBJECTIVES OF THE MTR**

The MTR will assess progress towards the achievement of the project objectives and outcomes as specified in the Project Document and assess early signs of project success or failure with the goal of identifying the necessary changes to be made in order to set the project on-track to achieve its intended results. The MTR will also review the project’s strategy and its risks to sustainability.

**4. MTR APPROACH & METHODOLOGY**

The MTR must provide evidence-based information that is credible, reliable and useful. The MTR team will review all relevant sources of information including documents prepared during the preparation phase (i.e. PIF, UNDP Initiation Plan, UNDP Environmental & Social Safeguard Policy, the Project Document, project reports including Annual Project Review/PIRs, project budget revisions, lesson learned reports, national strategic and legal documents, and any other materials that the team considers useful for this evidence-based review).

The MTR team is expected to follow a collaborative and participatory approach[[1]](#footnote-1) ensuring close engagement with the Project Team, government counterparts (the GEF Operational Focal Point), the UNDP Country Office(s), UNDP-GEF Regional Technical Advisers, and other key stakeholders.

Engagement of stakeholders is vital to a successful MTR.[[2]](#footnote-2) Stakeholder involvement should include interviews with stakeholders who have project responsibilities, including but not limited to partner mills from Batch 1 and 2; executing agencies, senior officials and task team/component leaders, key experts and consultants in the subject area, Project Board, project stakeholders, academia, local government and CSOs, etc. Additionally, the MTR team is expected to conduct field missions to Campinas and Brasília, including project sites to be defined jointly by UNDP and CTBE/CNPEM.

The final MTR report should describe the full MTR approach taken and the rationale for the approach making explicit the underlying assumptions, challenges, strengths and weaknesses about the methods and approach of the review.

**5. DETAILED SCOPE OF THE MTR**

The MTR team will assess the following four categories of project progress. See the *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects* for extended descriptions.

**i. Project Strategy**

Project design:

* Review the problem addressed by the project and the underlying assumptions. Review the effect of any incorrect assumptions or changes to the context to achieving the project results as outlined in the Project Document.
* Review the relevance of the project strategy and assess whether it provides the most effective route towards expected/intended results. Were lessons from other relevant projects properly incorporated into the project design?
* Review how the project addresses country priorities. Review country ownership. Was the project concept in line with the national sector development priorities and plans of the country (or of participating countries in the case of multi-country projects)?
* Review decision-making processes: were 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?
* Review the extent to which relevant gender issues were raised in the project design. See Annex 9 of *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects* for further guidelines.
* If there are major areas of concern, recommend areas for improvement.

Results Framework/Logframe:

* Undertake a critical analysis of the project’s logframe indicators and targets, assess how “SMART” the midterm and end-of-project targets are (Specific, Measurable, Attainable, Relevant, Time-bound), and suggest specific amendments/revisions to the targets and indicators as necessary.
* Are the project’s objectives and outcomes or components clear, practical, and feasible within its time frame?
* Examine if progress so far has led to, or could in the future catalyse beneficial development effects (i.e. income generation, gender equality and women’s empowerment, improved governance etc...) that should be included in the project results framework and monitored on an annual basis.
* Ensure broader development and gender aspects of the project are being monitored effectively. Develop and recommend SMART ‘development’ indicators, including sex-disaggregated indicators and indicators that capture development benefits.

**ii. Progress Towards Results**

Progress Towards Outcomes Analysis:

* Review the logframe indicators against progress made towards the end-of-project targets using the Progress Towards Results Matrix and following the *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects*; colour code progress in a “traffic light system” based on the level of progress achieved; assign a rating on progress for each outcome; make recommendations from the areas marked as “Not on target to be achieved” (red).

**Table. Progress Towards Results Matrix (Achievement of outcomes against End-of-project Targets)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Project Strategy** | **Indicator[[3]](#footnote-3)** | **Baseline Level[[4]](#footnote-4)** | **Level in 1st PIR (self- reported)** | **Midterm Target[[5]](#footnote-5)** | **End-of-project Target** | **Midterm Level & Assessment[[6]](#footnote-6)** | **Achievement Rating[[7]](#footnote-7)** | **Justification for Rating** |
| **Objective:**  | Indicator (if applicable): |  |  |  |  |  |  |  |
| **Outcome 1:** | Indicator 1: |  |  |  |  |  |  |  |
| Indicator 2: |  |  |  |  |  |
| **Outcome 2:** | Indicator 3: |  |  |  |  |  |  |  |
| Indicator 4: |  |  |  |  |  |
| Etc. |  |  |  |  |  |
| **Etc.** |  |  |  |  |  |  |  |  |

**Indicator Assessment Key**

|  |  |  |
| --- | --- | --- |
| Green= Achieved | Yellow= On target to be achieved | Red= Not on target to be achieved |

In addition to the progress towards outcomes analysis:

* Compare and analyse the GEF Tracking Tool at the Baseline with the one completed right before the Midterm Review.
* Identify remaining barriers to achieving the project objective in the remainder of the project.
* By reviewing the aspects of the project that have already been successful, identify ways in which the project can further expand these benefits.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Project Strategy** | **Indicator** | **Baseline Level** | **Level in 1st PIR** | **End of project target level** | **Midterm Level & Assessment[[8]](#footnote-8)** | **Achievement Rating[[9]](#footnote-9)** | **Justification for Rating** |
| Objective | 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 |  |  |  |
| 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 implemented 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 |  |  |  |
| 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 |  |  |  |
| 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 |  |  |  |
| 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 |  |  |  |
| 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. |  |  |  |
| Outcome 1 | Trash collection system design finalized and operational | No methodology to define trash to be collected in place  Conceptual design for trash collection system in place |  | Methodology defined and being used  Final design implemented and operational in mill #1 |  |  |  |
| 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 |  |  |  |
| Outcome 2 | 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 |  |  |  |
| Economic/financial performance of mills #1, #2, and #3 evaluated based on actual operating data and costs. | No trash-electricity system available Electricity exports from mills limited to excess energy generated with sugarcane bagasse without trash |  | Economic feasibility demonstrated for use of trash to make exportable electricity at mills #1, #2, and #3.  70 % increase in sale of electricity at mills #1, #2, and #3 due to inclusion of additional sugarcane trash |  |  |  |
| Outcome 3 | Guidelines for environmentally acceptable trash utilization completed and distributed | No guidelines required as no trash system is in use |  | Guidelines completed and in use |  |  |  |
| 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.  Sector wide analysis of CDM potential for enhanced trash use. |  |  |  |
| Sugarcane expansion clearly demonstrated as having minimal impact on deforestation rates in Brazil | Studies conducted to date do not link sugar sector to increased deforestation |  | Specific assessment conducted to demonstrate the potential impacts on deforestation  Mitigation strategy developed and under implementation |  |  |  |
| Additional removal of trash for electricity generation demonstrated no 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 |  |  |  |
| Outcome 4 | 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 |  |  |  |
| 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 |  |  |  |
| 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 |  |  |  |
| Mill #4 invests in electricity generation with bagasse | Mill #4 not yet committed to project implementation |  | Funding is leveraged from mill #4 to implement generation of electricity with trash. |  |  |  |
| 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 |  |  |  |
| Outcome 5 | 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  Meetings conducted with relevant state 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 |  |  |  |
| Outcome 6 | Internal monitoring is applied and adaptive feedback mechanisms are implemented | Internal monitoring procedure described in project document Project document reflects current understanding of best project strategy |  | Internal monitoring procedures implemented with at least two project reports generated per year  Project implementation strategy is strengthened by continuous integration of lessons learnt during implementation |  |  |  |
| High quality external evaluations are conducted | No evaluations conducted |  | One Mid Term evaluation and One Final Evaluation conducted |  |  |  |

**iii. Project Implementation and Adaptive Management**

Management Arrangements:

* Review overall effectiveness of project management as outlined in the Project Document/Substantive Revision. Have changes been made and are they effective? Are responsibilities and reporting lines clear? Is decision-making transparent and undertaken in a timely manner? Recommend areas for improvement.
* Review the quality of execution of the Executing Agency/Implementing Partner(s) and recommend areas for improvement.
* Review the quality of support provided by the GEF Partner Agency (UNDP) and recommend areas for improvement.

Work Planning:

* Review any delays in project start-up and implementation, identify the causes and examine if they have been resolved.
* Are work-planning processes results-based? If not, suggest ways to re-orientate work planning to focus on results?
* Examine the use of the project’s results framework/ logframe as a management tool and review any changes made to it since project start.

Finance and co-finance:

* Consider the financial management of the project, with specific reference to the cost-effectiveness of interventions.
* Review the changes to fund allocations as a result of budget revisions and assess the appropriateness and relevance of such revisions.
* Does the project have the appropriate financial controls, including reporting and planning, that allow management to make informed decisions regarding the budget and allow for timely flow of funds?
* Informed by the co-financing monitoring table to be filled out, provide commentary on co-financing: is co-financing being used strategically to help the objectives of the project? Is the Project Team meeting with all co-financing partners regularly in order to align financing priorities and annual work plans?

Project-level Monitoring and Evaluation Systems:

* Review the monitoring tools currently being used: Do they provide the necessary information? Do they involve key partners? Are they aligned or mainstreamed with national systems? Do they use existing information? Are they efficient? Are they cost-effective? Are additional tools required? How could they be made more participatory and inclusive?
* Examine the financial management of the project monitoring and evaluation budget. Are sufficient resources being allocated to monitoring and evaluation? Are these resources being allocated effectively?

Stakeholder Engagement:

* Project management: Has the project developed and leveraged the necessary and appropriate partnerships with direct and tangential stakeholders?
* Participation and country-driven processes: Do local and national government stakeholders support the objectives of the project? Do they continue to have an active role in project decision-making that supports efficient and effective project implementation?
* Participation and public awareness: To what extent has stakeholder involvement and public awareness contributed to the progress towards achievement of project objectives?

Reporting:

* Assess how adaptive management changes have been reported by the project management and shared with the Project Board.
* Assess how well the Project Team and partners undertake and fulfil GEF reporting requirements (i.e. how have they addressed poorly-rated PIRs, if applicable?)
* Assess how lessons derived from the adaptive management process have been documented, shared with key partners and internalized by partners.

Communications:

* Review internal project communication with stakeholders: Is communication regular and effective? Are there key stakeholders left out of communication? Are there feedback mechanisms when communication is received? Does this communication with stakeholders contribute to their awareness of project outcomes and activities and investment in the sustainability of project results?
* Review external project communication: Are proper means of communication established or being established to express the project progress and intended impact to the public (is there a web presence, for example? Or did the project implement appropriate outreach and public awareness campaigns?)
* For reporting purposes, write one half-page paragraph that summarizes the project’s progress towards results in terms of contribution to sustainable development benefits, as well as global environmental benefits.

**iv. Sustainability**

* Validate whether the risks identified in the Project Document/Substantive Revision, Annual Project Review/PIRs and the ATLAS Risk Management Module are the most important and whether the risk ratings applied are appropriate and up to date. If not, explain why.
* In addition, assess the following risks to sustainability:

Financial risks to sustainability:

* What is the likelihood of financial and economic resources not being available once the GEF assistance ends (consider potential resources can be from multiple sources, such as the public and private sectors, income generating activities, and other funding that will be adequate financial resources for sustaining project’s outcomes)?

Socio-economic risks to sustainability:

* Are there any social or political risks that may jeopardize sustainability of project outcomes? What is the risk that the level of stakeholder ownership (including ownership by governments and other key stakeholders) will be insufficient to allow for the project outcomes/benefits to be sustained? Do the various key stakeholders see that it is in their interest that the project benefits continue to flow? Is there sufficient public / stakeholder awareness in support of the long-term objectives of the project? Are lessons learned being documented by the Project Team on a continual basis and shared/ transferred to appropriate parties who could learn from the project and potentially replicate and/or scale it in the future?

Institutional Framework and Governance risks to sustainability:

* Do the legal frameworks, policies, governance structures and processes pose risks that may jeopardize sustenance of project benefits? While assessing this parameter, also consider if the required systems/ mechanisms for accountability, transparency, and technical knowledge transfer are in place.

Environmental risks to sustainability:

* Are there any environmental risks that may jeopardize sustenance of project outcomes?

**Conclusions & Recommendations**

The MTR team will include a section of the report setting out the MTR’s evidence-based conclusions, in light of the findings.[[10]](#footnote-10)

Recommendations should be succinct suggestions for critical intervention that are specific, measurable, achievable, and relevant. A recommendation table should be put in the report’s executive summary. See the *Guidance For Conducting Midterm Reviews of UNDP-Supported, GEF-Financed Projects* for guidance on a recommendation table.

The MTR team should make no more than 15 recommendations total.

**Ratings**

The MTR team will include its ratings of the project’s results and brief descriptions of the associated achievements in a *MTR Ratings & Achievement Summary Table* in the Executive Summary of the MTR report. See Annex E for ratings scales. No rating on Project Strategy and no overall project rating is required.

**Table. MTR Ratings & Achievement Summary Table for (*Sugarcane Renewable Electricity*)**

|  |  |  |
| --- | --- | --- |
| **Measure** | **MTR Rating** | **Achievement Description** |
| **Project Strategy** | N/A |  |
| **Progress Towards Results** | Objective Achievement Rating: (rate 6 pt. scale) |  |
| Outcome 1 Achievement Rating: (rate 6 pt. scale) |  |
| Outcome 2 Achievement Rating: (rate 6 pt. scale) |  |
| Outcome 3 Achievement Rating: (rate 6 pt. scale) |  |
| Etc.  |  |
| **Project Implementation & Adaptive Management** | (rate 6 pt. scale) |  |
| **Sustainability** | (rate 4 pt. scale) |  |

1. **TIMEFRAME**

The total duration of the MTR will be approximately *30* working daysover a time period of *12* of weeks and shall not exceed five months from when the consultant is hired. The tentative MTR timeframe is as follows:

|  |  |  |
| --- | --- | --- |
| **ACTIVITY** | **NUMBER OF WORKING DAYS**  | **COMPLETION DATE** |
| Document review and preparing MTR Inception Report (MTR Inception Report due no later than 2 weeks before the MTR mission) | *4 days*  | *November 16, 2018* |
| MTR mission: stakeholder meetings, interviews, field visits (mission to Brazil from November 26- December 07 - tbc) | *14 days*  | *December 6, 2018* |
| Presentation of initial findings- last day of the MTR mission | *1 day* | *December 7, 2018* |
| Preparing draft report (due within 3 weeks of the MTR mission) | *8 days*  | *January 4, 2019* |
| Finalization of MTR report/ Incorporating audit trail from feedback on draft report (due within 1 week of receiving UNDP comments on the draft) | *3 days*  | *January 31, 2019* |

Options for site visits should be discussed in the Inception Report, between the consultant, UNDP and CTBE/CNPEM.

1. **MIDTERM REVIEW DELIVERABLES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **Deliverable** | **Description** | **Timing** | **Responsibilities** |
| **1** | **MTR Inception Report** | MTR team clarifies objectives and methods of Midterm Review | No later than 2 weeks before the MTR mission | MTR team submits to the Commissioning Unit and project management |
| **2** | **Presentation** | Initial Findings | End of MTR mission | MTR Team presents to project management and the Commissioning Unit |
| **3** | **Draft Final Report** | Full report (using guidelines on content outlined in Annex B) with annexes | Within 3 weeks of the MTR mission | Sent to the Commissioning Unit, reviewed by RTA, Project Coordinating Unit, GEF OFP |
| **4** | **Final Report\*** | Revised report with audit trail detailing how all received comments have (and have not) been addressed in the final MTR report | Within 1 week of receiving UNDP comments on draft | Sent to the Commissioning Unit |

\*The final MTR report must be in English. If applicable, the Commissioning Unit may choose to arrange for a translation of the report into a language more widely shared by national stakeholders.

1. **MTR ARRANGEMENTS**

The principal responsibility for managing this MTR resides with the Commissioning Unit. The Commissioning Unit for this project’s MTR is UNDP Country Office in Brazil in close collaboration with CTBE/CNPEM.

The commissioning unit will contract the consultants and ensure the timely provision of per diems and travel arrangements within the country for the MTR team. The Project Team will be responsible for liaising with the MTR team to provide all relevant documents, set up stakeholder interviews, and arrange field visits.

1. **CONSULTANT PROFILE**

One independent consultant will conduct the MTR with experience and exposure to projects and evaluations. The consultant should not have a conflict of interest with project’s related activities.

The selection of the consultant will be aimed at maximizing the qualities in the following areas:

* Recent experience with result-based management evaluation methodologies;
* Experience applying SMART indicators and reconstructing or validating baseline scenarios;
* Competence in adaptive management, as applied to Climate Change/Energy;
* Experience working with the GEF or GEF-evaluations;
* Experience working in Latin America;
* Work experience in relevant technical areas for at least 10 years;
* Demonstrated understanding of issues related to gender and Climate Change/Energy and experience in gender sensitive evaluation and analysis is an asset.
* Working knowledge in Portuguese is an asset;
* English is mandatory;
* Project evaluation/review experiences within United Nations system will be considered an asset;
* A Master’s degree in related Climate Change/Energy areas, or other closely related field.
1. **PAYMENT MODALITIES AND SPECIFICATIONS**

10% of payment upon approval of the final MTR Inception Report

30% upon submission of the draft MTR report

60% upon finalization of the MTR report

1. **APPLICATION PROCESS[[11]](#footnote-11)**

**Recommended Presentation of Proposal:**

1. **Letter of Confirmation of Interest and Availability** using the [template](https://intranet.undp.org/unit/bom/pso/Support%20documents%20on%20IC%20Guidelines/Template%20for%20Confirmation%20of%20Interest%20and%20Submission%20of%20Financial%20Proposal.docx)[[12]](#footnote-12) provided by UNDP;
2. **CV** and a **Personal History Form** ([P11 form](http://www.undp.org/content/dam/undp/library/corporate/Careers/P11_Personal_history_form.doc)[[13]](#footnote-13));
3. **Brief description of approach to work/technical proposal** of why the individual considers him/herself as the most suitable for the assignment, and a proposed methodology on how they will approach and complete the assignment; (max 1 page)
4. **Financial Proposal** that indicates the all-inclusive fixed total contract price and all other travel related costs (such as flight ticket, per diem, etc), supported by a breakdown of costs, as per template attached to the [Letter of Confirmation of Interest template](http://procurement-notices.undp.org/view_file.cfm?doc_id=29916). If an applicant is employed by an organization/company/institution, and he/she expects his/her employer to charge a management fee in the process of releasing him/her to UNDP under Reimbursable Loan Agreement (RLA), the applicant must indicate at this point, and ensure that all such costs are duly incorporated in the financial proposal submitted to UNDP.

All application materials should be submitted to the address (fill address) in a sealed envelope indicating the following reference “Consultant for BRA10G31 SUCRE Midterm Review” or by email at the following address ONLY: (fill email) This email address is being protected from spam bots, you need Javascript enabled to view it by ***November 05th, 2018.*** Incomplete applications will be excluded from further consideration.

**Criteria for Evaluation of Proposal:** Only those applications which are responsive and compliant will be evaluated. Offers will be evaluated according to the Combined Scoring method – where the educational background and experience on similar assignments will be weighted at 70%and the price proposal will weigh as 30% of the total scoring. The applicant receiving the Highest Combined Score that has also accepted UNDP’s General Terms and Conditions will be awarded the contract.

**ToR ANNEX A: List of Documents to be reviewed by the MTR Team**

1. PIF
2. UNDP Initiation Plan
3. UNDP Project Document and Substantive Revision
4. UNDP Environmental and Social Screening results
5. Project Inception Report
6. All Project Implementation Reviews (PIR’s)
7. Progress reports and work plans of the various implementation task teams
8. Audit reports
9. Oversight mission reports
10. All monitoring reports prepared by the project
11. Financial and Administration guidelines used by Project Team

The following documents will also be available:

1. Project operational guidelines, manuals and systems
2. UNDP country/countries programme document(s)
3. Minutes of the *Sugarcane Renewable Electricity* Board Meetings and other meetings (i.e. Project Appraisal Committee meetings)
4. Project site location maps

**ToR ANNEX B: Guidelines on Contents for the Midterm Review Report**[[14]](#footnote-14)

|  |  |
| --- | --- |
| **i.** | Basic Report Information *(for opening page or title page)** Title of UNDP supported GEF financed project
* UNDP PIMS# and GEF project ID#
* MTR time frame and date of MTR report
* Region and countries included in the project
* GEF Operational Focal Area/Strategic Program
* Executing Agency/Implementing Partner and other project partners
* MTR team members
* Acknowledgements
 |
| **ii.**  | Table of Contents |
| **iii.** | Acronyms and Abbreviations |
| **1.** | Executive Summary *(3-5 pages)* * Project Information Table
* Project Description (brief)
* Project Progress Summary (between 200-500 words)
* MTR Ratings & Achievement Summary Table
* Concise summary of conclusions
* Recommendation Summary Table
 |
| **2.** | Introduction *(2-3 pages)** Purpose of the MTR and objectives
* Scope & Methodology: principles of design and execution of the MTR, MTR approach and data collection methods, limitations to the MTR
* Structure of the MTR report
 |
| **3.** | Project Description and Background Context *(3-5 pages)** Development context: environmental, socio-economic, institutional, and policy factors relevant to the project objective and scope
* Problems that the project sought to address: threats and barriers targeted
* Project Description and Strategy: objective, outcomes and expected results, description of field sites (if any)
* Project Implementation Arrangements: short description of the Project Board, key implementing partner arrangements, etc.
* Project timing and milestones
* Main stakeholders: summary list
 |
| **4.** | Findings *(12-14 pages)* |
| **4.1** | Project Strategy* Project Design
* Results Framework/Logframe
 |
| **4.2** | Progress Towards Results * Progress towards outcomes analysis
* Remaining barriers to achieving the project objective
 |
| **4.3** | Project Implementation and Adaptive Management* Management Arrangements
* Work planning
* Finance and co-finance
* Project-level monitoring and evaluation systems
* Stakeholder engagement
* Reporting
* Communications
 |
| **4.4** | Sustainability* Financial risks to sustainability
* Socio-economic to sustainability
* Institutional framework and governance risks to sustainability
* Environmental risks to sustainability
 |
| **5.** | Conclusions and Recommendations *(4-6 pages)* |
|  |  **5.1**   | Conclusions * Comprehensive and balanced statements (that are evidence-based and connected to the MTR’s findings) which highlight the strengths, weaknesses and results of the project
 |
|  **5.2** | Recommendations * 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
 |
| **6.**  | Annexes* MTR ToR (excluding ToR annexes)
* MTR evaluative matrix (evaluation criteria with key questions, indicators, sources of data, and methodology)
* Example Questionnaire or Interview Guide used for data collection
* Ratings Scales
* MTR mission itinerary
* List of persons interviewed
* List of documents reviewed
* Co-financing table (if not previously included in the body of the report)
* Signed UNEG Code of Conduct form
* Signed MTR final report clearance form
* *Annexed in a separate file:* Audit trail from received comments on draft MTR report
* *Annexed in a separate file:* Relevant midterm tracking tools (*METT, FSC, Capacity scorecard, etc.)*
 |

**ToR ANNEX C: Midterm Review Evaluative Matrix Template**

*(Questions to be filled out by the Commissioning Unit)*

This Midterm Review Evaluative Matrix must be fully completed/amended by the consultant and included in the MTR inception report and as an Annex to the MTR report.

|  |  |  |  |
| --- | --- | --- | --- |
| **Evaluative Questions** | **Indicators** | **Sources** | **Methodology** |
| **Project Strategy: To what extent is the project strategy relevant to country priorities, country ownership, and the best route towards expected results?**  |
| (include evaluative question(s)) | (i.e. relationships established, level of coherence between project design and implementation approach, specific activities conducted, quality of risk mitigation strategies, etc.) | (i.e. project documents, national policies or strategies, websites, project staff, project partners, data collected throughout the MTR mission, etc.) | (i.e. document analysis, data analysis, interviews with project staff, interviews with stakeholders, etc.) |
|  |  |  |  |
|  |  |  |  |
| **Progress Towards Results: To what extent have the expected outcomes and objectives of the project been achieved thus far?** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| **Project Implementation and Adaptive Management: Has the project been implemented efficiently, cost-effectively, and been able to adapt to any changing conditions thus far? To what extent are project-level monitoring and evaluation systems, reporting, and project communications supporting the project’s implementation?** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| **Sustainability: To what extent are there financial, institutional, socio-economic, and/or environmental risks to sustaining long-term project results?** |
|  |  |  |  |
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**ToR ANNEX D: UNEG Code of Conduct for Evaluators/Midterm Review Consultants[[15]](#footnote-15)**

**Evaluators/Consultants:**

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 limitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

**MTR Consultant Agreement Form**

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: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**ToR ANNEX E: MTR Ratings**

|  |
| --- |
| **Ratings for Progress Towards Results:** (one rating for each outcome and for the objective) |
| 6 | Highly Satisfactory (HS) | The objective/outcome is expected to achieve or exceed all its end-of-project targets, without major shortcomings. The progress towards the objective/outcome can be presented as “good practice”. |
| 5 | Satisfactory (S) | The objective/outcome is expected to achieve most of its end-of-project targets, with only minor shortcomings. |
| 4 | Moderately Satisfactory (MS) | The objective/outcome is expected to achieve most of its end-of-project targets but with significant shortcomings. |
| 3 | Moderately Unsatisfactory (HU) | The objective/outcome is expected to achieve its end-of-project targets with major shortcomings. |
| 2 | Unsatisfactory (U) | The objective/outcome is expected not to achieve most of its end-of-project targets. |
| 1 | Highly Unsatisfactory (HU) | The objective/outcome has failed to achieve its midterm targets, and is not expected to achieve any of its end-of-project targets. |

|  |
| --- |
| **Ratings for Project Implementation & Adaptive Management:** (one overall rating) |
| 6 | Highly Satisfactory (HS) | Implementation of all seven components – management arrangements, work planning, finance and co-finance, project-level monitoring and evaluation systems, stakeholder engagement, reporting, and communications – is leading to efficient and effective project implementation and adaptive management. The project can be presented as “good practice”. |
| 5 | Satisfactory (S) | Implementation of most of the seven components is leading to efficient and effective project implementation and adaptive management except for only few that are subject to remedial action. |
| 4 | Moderately Satisfactory (MS) | Implementation of some of the seven components is leading to efficient and effective project implementation and adaptive management, with some components requiring remedial action. |
| 3 | Moderately Unsatisfactory (MU) | Implementation of some of the seven components is not leading to efficient and effective project implementation and adaptive, with most components requiring remedial action. |
| 2 | Unsatisfactory (U) | Implementation of most of the seven components is not leading to efficient and effective project implementation and adaptive management. |
| 1 | Highly Unsatisfactory (HU) | Implementation of none of the seven components is leading to efficient and effective project implementation and adaptive management. |

|  |
| --- |
| **Ratings for Sustainability:** (one overall rating) |
| 4 | Likely (L) | Negligible risks to sustainability, with key outcomes on track to be achieved by the project’s closure and expected to continue into the foreseeable future |
| 3 | Moderately Likely (ML) | Moderate risks, but expectations that at least some outcomes will be sustained due to the progress towards results on outcomes at the Midterm Review |
| 2 | Moderately Unlikely (MU) | Significant risk that key outcomes will not carry on after project closure, although some outputs and activities should carry on |
| 1 | Unlikely (U) | Severe risks that project outcomes as well as key outputs will not be sustained |

**ToR ANNEX F: MTR Report Clearance Form**

*(to be completed by the Commissioning Unit and UNDP-GEF RTA and included in the final document)*

**Midterm Review Report Reviewed and Cleared By:**

**Commissioning Unit**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**UNDP-GEF Regional Technical Advisor**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**ToR ANNEX G: Audit Trail Template**

*Note:* The following is a template for the MTR Team to show how the received comments on the draft MTR report have (or have not) been incorporated into the final MTR report. This audit trail should be included as an annex in the final MTR report.

**To the comments received on (*date*) from the Midterm Review of (*project name*) (UNDP Project ID-*PIMS #)***

*The following comments were provided in track changes to the draft Midterm Review report; they are referenced by institution (“Author” column) and track change comment number (“#” column):*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author** | **#** | **Para No./ comment location**  | **Comment/Feedback on the draft MTR report** | **MTR team****response and actions taken** |
|  |  |  |  |  |
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**5.2 Work Plan and Questionnaire**

**5.2.1 Data Collection: Field Research**

Interviews with experts reporting on Renewable Electricity, especially electricity generated through sugarcane bagasse and straw, and with managers from sugarcane mills and others with issues relating to the issue:

1) Effectiveness of monitoring indicators that measured progress of the project;

2) How was the participation of civil society, NGOs and associations and stakeholders;

3) Did the implementation of the project have elements that could be replicable?

4) Are there links with other projects or programs?

5) Is there the possibility to include and incorporate more partners? What would you recommend?

6) How to see the sustainability of project actions?

7) Do you think the project could have a correction in its design or in its formulation?

8) Is it important to disseminate the project results?

9) What, in his or her view, are the best practices and worst practices from the implementation of the project? And what about the results impact?

- Data analysis will enable to raise the findings and lessons learned by the project and will also allow up recommendations for environmental public policies.

The research must also respond to the Midterm Revision questions on:

1) Relevance; 2) Effectiveness; 3) Efficiency; 4) Sustainability; 5) Impact

**5.3 List of Documents Reviewed**

 Reading and analysis of documents related to the Project BRA/10/G32:

* Project Document (PRODOC)
* Substantive Revision 1
* Terms of Reference
* Project Implementation Review (PIR) 2016, 2017 and 2018
* Annual Work Plan (AWP) 2015, 2016, 2017 and 2018
* Progress Report, 2115, 2016, 2018
* Audits Report
* CNPEM Documents
* MTR Reports – 001,002 and 003
* Meeting Notes
* Bulletins
* Accountability Reports
* Cooperation Agreement with Partners
* CNPEM Technical Report
* UNDP Guidance for Evaluation
* Executive Summary of Products

**5.4 List of persons interviewed**

**List of Interviewed Persons**

|  |  |  |
| --- | --- | --- |
| **Name** | **Institution** | **Locality** |
|  |
| Manoel Regis L. V. Leal | Project Director/CTBE-CNPEM | Campinas |
| Thayse Hernandes | CTBE/CNPEM | Campinas |
| Rose Diegues | UNDP/Program Officer | Brasília |
| Ludmila Diniz | Regional Technical Advisor – Energy, Infrastructure, Transport and Technology/UNDP – Global Environmental Financing Unit | Brasilia |
| Tania Jardim | Brazilian Cooperation Agency | Brasília |
| Viviane Celente | CTBE/CNPEM.  | Campinas |
| Gustavo Dezima Ramos | MCTIC | Campinas |
| Rafael Silva Menezes | MCTIC | Campinas |
| Guilherme Nehvebecki | Usina Alta Mogiana | Campinas |
| Marcio Cezarini Borges | Raizen | Campinas |
| Zilmar José de Souza | UNICA | Campinas |
| Ivan Monteiro da Silva | Usina da Pedra | Campinas |

**5.5 Summary of the Interviews**

**Data: 29/11 a 31 de Novembro de 2018**

**III Workshop de Resultados do SUCRE**

**Participants:**

**Mary Dayse Kinzo**

**Rosenely Diegues/Program Officer/UNDP**

**CTBE/CNPEM Equipe e Consultores do Projeto**

**Representantes das Usinas/Partners do SUCRE**

**Instituições relacionadas ao Projeto SUCRE**

**Representantes do governo, de instituições de pesquisa e da academia e organizações do setor sucroalcoleiro**

Participaram no Workshop cerca de 100 pessoas. Os resultados do Projeto SUCRE foram apresentados pela equipe. Os temas estavam relacionados com os resultados das últimas pesquisas como:

* remoção da palha no campo;
* metódo de recolhimento da palha;
* processamento da palha e sua viabilidade econômica e ambiental; e
* gargalos e sugestões de melhorias para a comercialização da bioeletricidade.

Além dos apresentadores dos temas que eram pesquisadores do CTBE, o workshop também contou com depoimentos de representantes das usinas parceiras do Projeto, versando sobre suas experiências com o processamento da palha para geração de energia elétrica.

O representante da empresa Raízen, parceiros do Projeto, Márcio Cezarini Borges afirmou que o grupo empresarial é exportador de bioeletricidade e responsável por 2,5 TWh ao ano ou 10% de toda a energia gerada e exportada para o grid nacional. A empresa tem planos de aumentar em quatro vezes o atual volume de recolhimento de palha de suas unidades até 2022.

De acordo com Borges, a visão da empresa Raizem é que a palha tem que ser vista cada vez mais como um produto, não subproduto ou resíduo. “Temos a possibilidade de usar a biomassa que está dentro de casa para gerar eletricidade e reduzir ainda mais a pegada de carbono no País”, afirmou Borges.

O III Workshop terminou com depoimentos dos representantes das usinas participantes do Projeto SUCRE e um deles afirmou que “com o Projeto SUCRE começamos de fato a ter dados para tomar decisões”. Ivan Monteiro, representante da Usina Pedra, disse em seu depoimento que o Projeto contribuiu imensamente para a melhoria dos equipamentos e que atualmente, a empresa tem consciência da importância do aproveitamento não só do bagaço da cana, mas também da palha que antes era queimada. O representante termina com a expectativa de que as discussões continuem para que obtenham um maior conhecimento sobre os temas que têm sido pesquisados pelo SUCRE.

**Data: 30/11/2018**

**Reunião da Comissão do Projeto SUCRE**

**Participantes:**

**Thayse Hernandes: Coordenadora do Projeto SUCRE**

**Manoel Regis L. V. Leal: Diretor Nacional do Projeto SUCRE/CTBE-CNPEM**

**Eduardo do Couto e Silva: Diretor CTBE/CNPEM**

**Rosenely Diegues: Oficial de Programa PNUD**

**Representantes das Usinas: Raizen, Da Pedra, Alta Mogiana, Quatá e outras**

**Representante da organização UNICA: Zilmar Souza**

**Representantes do MCTIC: Gustavo Dezima Ramos, Rafael Silva Menezes**

**Consultora Mary Dayse Kinzo**

Após a reunião da Comissão, a Consultora iniciou as entrevistas com os participantes.

**Rose Diegues** apresentou o TOR da Consultora para a realização do MTR. Explicou como deveria apresentar os dados coletados e as análises realizadas. Algumas perguntas foram feitas e tiveram respostas da Oficial de Programa do PNUD.

**Thayse Hernandes** fez uma apresentação do Projeto SUCRE em powerpoint, abordando seus componentes, objetivo, atividades e resultados. A Coordenadora do Projeto deu uma visão geral sobre os resultados já obtidos e deu uma visão geral dos participantes do Projeto.

**Manoel Regis Leal** fez uma colocação sobre os problemas solucionados, principalmente junto às usinas e as dificuldades em adequar os equipamentos e as práticas em uso.

**Gustavo Dezima Ramos e Rafael Silva Menezes,** representantes do MCTIC, fizeram uma explanação sobre as origins do Projeto e os procedimentos realizados pelo Ministério, por meio de seu chefe, para que o Projeto não fosse cancelado. O cancelamento poderia ser realizado se não fizessem empenho para que fosse apresentado outra agência executora. Isto porque, após aprovação do Projeto e doação de recursos pelo GEF, a agência executora da época CTC tornou-se inelegível para o encargo. A instituição teria transformado sua personalidade de organização sem fins lucrativos em personalidade jurídica. Houve assim necessidade de apresentação de nova agência executora para o Projeto e aprovação pelo GEF/PNUD e Governo Brasileiro. Com estes problemas, a implementação do Projeto só teve início em 2015 e tendo como agência executora o CTBE/CNPEM.

**Representantes das Usinas,** também foram entrevistados. Estes apresentaram as dificuldades encontradas para a geração de bioeletricidade a partir da palha da cana de açúcar. Eles também apresentaram as dificuldades na adequação dos equipamentos e discorreram sobre os gastos que as usinas tiveram que empreender para o fim a que se propuseram.

**Representante da UNICA: Zilmar de Souza** fez uma explanação sobre as dificuldades em incorporar uma energia bioelétrica no sistema nacional. Explanou sobre as reuniões já realizadas e como neste final de governo tudo se tornou difícil. Mostrou também, com apoio dos representantes das usinas, como a energia já vendida está sendo difícil de receber o valor devido. Isto porque, a questão tornou-se questão jurídica de cobrança ao sistema de outras energias e da energia elétrica gerada da palha da cana de açúcar. A expectativa é que, com novo governo e novos representantes do ministérios, possam realizar seminários e reuniões para solução de problemas vinculados à comercialização da bioenergia e sua incorporação no Sistema Nacional.

Zilmar afirma que é preciso impulsionar estas discussões e colocar a bioenergia no sistema o mais rápido possível, uma vez que a demanda é alta no país. Diz ele que, “é preciso se contrapor ao velho argumento de que a bioeletricidade é cara”. É preciso mostrar estudos recentes do Instituto Escolhas que atribui valores a atributos outros que os investimentos na construção de uma usina e os custos de sua operação.

Assim, a avaliadora realizou entrevistas com os principais atores vinculados ao Projeto SUCRE, aproveitando da participação no III Workshop de apresentação de resultados do Projeto e participando da reunião da Comissão Técnica realizando entrevistas individuais com os participantes.

**Data: 30/11/2018**

**Reunião por telefone com:**

**Ludmilla Diniz – Regional Technical Advisor (RTA), Panamá**

Algumas questões foram formuladas para a RTA:

- Como você vê a sustentabilidade do Projeto, quando está na dependência do estabelecimento do Marco Regulatório do Sistema Nacional de Energia do Governo Brasileiro?

R. Vê problemas se não conseguirem solucionar este problema. Mas, com o crescimento da demanda fica difícil o sistema não incorporar com valores justos a bioeletricidade.

- A replicação das atividades do Projeto será possível, em seu ponto de vista?

R. Acho que ainda terá um tempo para a finalização do Projeto, após a extensão de prazo e acredito que farão contatos com outras regiões e planejarão a replicação.

- Como você vê a possibilidade de outro Projeto, agora que pensam na apresentação de bioeletricidade por meio do processamento da vinhaça?

R. Vejo com bons olhos, uma vez que é importante aumentar as fontes de geração de energia renovável.

- Que recomendações você faria para a finalização do Projeto e inclusão no relatório MTR.

As recomendações foram incorporadas ao relatório MTR e foram de grande valia para a legitimação das conclusões. Entre as recomendações destaca-se a importância de disseminar por diversas fontes e midias os resultados para maior conscientização da importância da geração de energias renováveis, além das hidroetétricas.

**5.6 UNDP-GEF TE Report Audit Trail**

**To the comments received on January and February from the Midterm Review of BRA/10/G31 “SUCRE Project”, UNDP Project ID: 00064077-PIMS*: 3515***

*The following comments were provided in track changes to the draft Midterm Review report; they are referenced by institution (“Author” column) and track change comment number (“#” column):*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author** | **#** | **Para No./ comment location**  | **Comment/Feedback on the draft MTR report** | **MTR team****response and actions taken** |
| TADH1 |  | p.33 | Isso é realmente citado? Não seria climate changes ou algo mais nessa linha? | Done |
| TADH2 |  | p.33 | Five-year? | Done |
| MRLVL3 |  | p.37 | O Projeto BRA/96/G31 considerava o uso de biomassa da cana apenas (bagaço e palha). Floresta plantada era prevista no projeto CHESF/SHELL | Done |
| TADH4 |  | p.38 | Mais uma vez, isso me parece objetivo do outro projeto GEF (Protocolo de Montreal) | Done |
| TADH5 |  | p.38 | PRODOC | Done |
| TADH6 |  | p.39 | Is being? | Done |
| MRLVL7 |  | P.39 | CTC is not part of the SUCRE! | Done |
| TADH8 |  | p.43 | Isso é anteprojeto, não está em andamento… | Done |
| TADH9 |  | p.43 | Precisa falar destes outros projetos? | Done |
| TADH10 |  | p.43 | Informação não foi fornecida pela equipe do projeto Sucre | Done |
| TADH11 |  | p.45 | ?MTE | Done |
| TADH12 |  | p.46 | As regras seguidas são as do CNPEM. A execução é realizada pelo CNPEM.Thayse: Sim, mas complied with UNDP rules! | Done |
| TADH13 |  | p.48 | Regarding pests and diseases | Done |
| TADH14 |  | p.54 | Neste ponto, particularmente acho que deveria ser citado o fato de que a execução financeira foi corrigida. Além disso, o planejamento inicial que foi errôneo ao considerar que o projeto executaria praticamente o mesmo montante para todos os anos, pois é sabido que a execução começa mais lenta, atinge seu ápice no meio do projeto e no final diminui novamente. Esta é exatamente a curva de execução financeira do Sucre após adaptações. | Done |
| TADH15 |  | p.55 | Identification and test | Done |
| TADH16 |  | p.56 | Não está muito claro. | Done |
| TADH17 |  | p.60 | Não é isso, correto? | Done |
| TADH18 |  | p.89 | ? | Done |
| TADH19 |  | p.89 | A parte social é citada inúmeras vezes. Entretanto, a componente de avaliação dos impactos sociais não estava prevista no projeto e deve ser considerada como algo além dos indicadores. | Done |
| TADH20 |  | p.93 | Em cada local, os impactos de remoção da palha são diferentes e é isso que o projeto mostrará nos guidelines. Não tem nada a ver com ILUC | Done |
| TADH21 |  | p.93 | ? | Done |
| TADH22 |  | p.96 | productivity | Done |
| TADH23 |  | p.98 | Isto não está no PRODOC, mas estamos fazendo como um “plus” | Done |
| TADH24 |  | p.98 | Esta é justamente a área onde temos mais artigos revisados por pares publicados em revistas de alto impacto. Este tema necessita de grande número de experimentos e de um tempo de avaliação maior do que a duração do projeto. Entretanto, a equipe vem se dedicando para conseguir produzir resultados relevantes em menos de cinco anos e todos estes achados estão sendo submetidos a pares nacionais e internacionais através de submissão e publicação de artigos em revistas de alto impacto. Neste ano, o Journal Bioenergy Research fará uma edição especial sobre palha, com o Sucre como grande destaque. Seguem alguns artigos já publicados e uma previsão de outros artigos que serão submetidos em breve, no escopo do Sucre. | Done |
| TADH25 |  | p.98 | Questão de governança. | Done |
| TADH26 |  | p.98 | Não há como verificar em campo os 4 milhões de hectares de expansão da cana nos últimos anos. Justamente por essa razão a equipe optou por ferramentas de sensoriamento remoto para avaliar os efeitos diretos da expansão da cana no desmatamento. Esta metodologia é bem consolidada e conhecida no meio acadêmico e, este estudo já foi submetido à audiência internacional especializada (Biomass Conference) e será submetido, por meio de um artigo científico, à revisão por pares. | Done |
| TADH27 |  | p.99 | Os resultados do projeto estão sendo extrapolados na medida do possível. | Done |
| EK1 |  | p.88,89,90,91 | This is not meant to be assessed at this stage, please review the TOR annex related to the content and the guidance to carry out midterm reviews of GEF projects.  | Done |
| EK2 |  | p.92,93 | Likewise | Done |
| EK3 |  | p.9 | Please use the relevant summary ratings table, see below | Done |
| EK4 |  | p.15 | Please revise using the Guidance for Conducting Midterm Reviews of UNDP-Supported GEF-Financed Projects | Done |
| EK5 |  | p.17 | Not relevant at this stage | Done |
| EK6 |  | p.17 | Please group under adaptive management | Done |
| EK7 |  | p.18 | Not relevant at this stage | Done |
| EK8 |  | p.18 | Please complete | Done |
| EK9 |  | p.33 | Please use the table below to update on the achievement of the project against the described substantive revision logical framework. | Done |
| EK10 |  | p.45 | Is this the structure after the substantive revision? Please include the three tier UNDP project assurance mechanism (UNDP country office, Regional Hub and HQ) | Done |
| EK11 |  | p.50 | Please include co-financing execution. As this can’t be measured, please just request the implementing partner to provide an approximate figure | Done |
| EK12 |  | p.50 | Title | Done |
| EK13 |  | p.88 | Not relevant criteria at this stage | Done |
| EK14 |  | p.91 | Please elaborate using the criteria of:1. Financial risks to sustainability
2. Socio-economic risks to sustainability
3. Institutional framework and governance risks to sustainability
4. Environmental risks to sustainability.
 | Done |
| EK15 |  | p.92 | Not the moment to assess impact. | Done |
| EK16 |  | p.93 | Please use the MTR table. | Done |
| EK17 |  | p.94 | Please add footnotes with the relevant references to the experiments | Done |
| EK18 |  | p.95 | As above, please provide evidence. | Done |
| EK19 |  | p.95 | Maybe adding all studies to the bibliography consulted would be useful | Done |
| RDP2 |  | p.7 | We need to have data on how much is the co-financing from each source. CTBE seems to have this information, kindly check with them | Done |
| TADH3 |  | p.7 | Considering the average exchange rate during all the Sucre development (US$ 1.00 correspond to R$ 3.48), the participation of the partner mills in project co-financing correspond to US$ 151,724,137.93. From us (CTBE), the co-financing concerning only human resources corresponds to US$ 2,985,420.00, however, CTBE is accounting the co-financing participation from the use of CTBE’s infrastructure. | Done |
| LD4 |  | p.11 | In which sense they are high or lower in emission? | Done |
| LD9 |  | p.14 | I miss here some reflection on the engagement with private sector leveraging investments and the partnership with tech research and innovation centers as a success element of the project.  | Done |
| TADH10 |  | p.14 | From more than 20 papers already published by the project team, the major portion were from the impacts of straw removal on soil quality and sugarcane productivity (<https://pages.cnpem.br/sucre/publicacoes/>). In addition, it was held at CTBE in 2018 an academic event exclusively to discuss tis subject (<https://pages.cnpem.br/sucre/workshop-remocao/>), and in September, 2019 we will promote a second edition of that event. Because of the event in 2018, an important journal (Bioenergy Research) has invited Sucre team to make an especial edition about sugarcane straw and soil and productivity impacts. This edition will be finished on April 2019 and will be published soon. We kindly ask for some new ideas regarding academic dissemination of those results.  | Done |
| RDP!8 |  | p.21 | Here you could also include other aspects to the evaluations, as per guidelines:• Assessment of **progress** towards results; • Monitoring of **implementation** and **adaptive management** to improve outcomes; • Early identification of **risks to sustainability;** • Emphasis on **supportive recommendations.** | Done |
| RDP21 |  | p.23 | Maybe you could explore a little bit the project start here, explaining why we had to undertake the substantive revision in the first place, explaining to the general public that does not know the context in which CTBE became the executing agency of the project. This information is in the background/context of the substantive revision.  | Done |
| LD23 |  | p.25 | The context should be divided data and references from PRODOC and substantive revision in order to be updated. The context of change of executing agency is key as well.  | Done |
| RDP24 |  | p.29 | The context should be divided data and references from PRODOC and substantive revision in order to be updated. The context of change of executing agency is key as well.  | Done |
| RDP50 |  | p.66 | Here is does not apply. CTBE does not follow UNDP rules and regulations for procurement, they follow their own guidelines. This can be confirmed at auditing reports. Kindly confirm with CTBE what is meant here. Here you should separate the role of UNDP as implementing partner and CTBE as executing agency, ok? Maybe put one subitem for each? Ludmila/Ernesto, kindly confirm.  | Done |
| RDP53 |  | p.71 | We should try to have an estimate of those amounts in US$. Maybe per year of purchase of equipment for investment? Or should we account using exchange rate for this month, for instance? Ideas are welcome.  | Done |
| TADH54 |  | p.71 | We should try to have an estimate of those amounts in US$. Maybe per year of purchase of equipment for investment? Or should we account using exchange rate for this month, for instance? Ideas are welcome.  | Done |
| LD60 |  | p.103 | I miss a section on Communication. Project has a website, has been active in sharing information through events, articles, press releases, newsletter. Please acknowledge this and indicate project´s website.  | Done |
| LD61 |  | p.65 | Are there an preliminary figures on CO2 reductions? Also on Energy generation estimations related to activities supported by the project. This is the space to condense the main figures and data related to project achievements. Please see comments on executive summary for this section | Done |
| RDP63 |  | p.108 | Kindly spell out what is the period. One of the main points for extension needs to be the technical guidance provided by the MTE, thus, we cannot have a circular point: we need the MTE to provide us with the reason to extend the project and not the other way around.  | Done |
| RDP64 |  | p.108 | Again, here we need to have the MTE recommendation, that can converge with mine, but not be circular. Kindly rephrase it in a way that latter UNDP can use it as a MTE recommendation. Are we talking about creating subgroups/technical groups at the project advisory committee, right?  | Done |
| RDP65 |  | p.108 | Again, here we need to have the MTE recommendation,that can converge with mine, but not be circular. Kindly rephrase it in a way that latter UNDP can use it as a MTE recommendation. Are we talking about creating subgroups/technical groups at the project advisory committee, right?  | Done |
| LD66 |  | p.108 | This recommendation is not clear. Document in which way? | Done |
| RDP69 |  | p.110 | Specific suggestions would be welcome – maybe in the recommendation. We already have them included in the PAC. How can we do this?  | Done |
| LD69 |  | p.110 | Specific suggestions would be welcome – maybe in the recommendation. We already have them included in the PAC. How can we do this?  | Done |
| RDP66 |  | p.109 | Does it mean having seminars? Dissemination materials? Do we have these programmed for 2019?  | Done |

**5.7 MTR Report Clearance Form**

**ToR ANNEX F: MTR Report Clearance Form**

*(to be completed*

**Midterm Review Report Reviewed and Cleared By:**

**Commissioning Unit**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**UNDP-GEF Regional Technical Advisor**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. For ideas on innovative and participatory Monitoring and Evaluation strategies and techniques, see [UNDP Discussion Paper: Innovations in Monitoring & Evaluating Results](http://www.undp.org/content/undp/en/home/librarypage/capacity-building/discussion-paper--innovations-in-monitoring---evaluating-results/), 05 Nov 2013. [↑](#footnote-ref-1)
2. For more stakeholder engagement in the M&E process, see the [UNDP Handbook on Planning, Monitoring and Evaluating for Development Results](http://www.undg.org/docs/11653/UNDP-PME-Handbook-%282009%29.pdf), Chapter 3, pg. 93. [↑](#footnote-ref-2)
3. Populate with data from the Logframe and scorecards [↑](#footnote-ref-3)
4. Populate with data from the Project Document [↑](#footnote-ref-4)
5. If available [↑](#footnote-ref-5)
6. Color code this column only [↑](#footnote-ref-6)
7. Use the 6 point Progress Towards Results Rating Scale: HS, S, MS, MU, U, HU [↑](#footnote-ref-7)
8. Colour code this column only [↑](#footnote-ref-8)
9. Use the 6 point Progress Towards Results Rating Scale: HS, S, MS, MU, U, HU [↑](#footnote-ref-9)
10. Alternatively, MTR conclusions may be integrated into the body of the report. [↑](#footnote-ref-10)
11. Engagement of the consultants should be done in line with guidelines for hiring consultants in the POPP: <https://info.undp.org/global/popp/Pages/default.aspx> [↑](#footnote-ref-11)
12. <https://intranet.undp.org/unit/bom/pso/Support%20documents%20on%20IC%20Guidelines/Template%20for%20Confirmation%20of%20Interest%20and%20Submission%20of%20Financial%20Proposal.docx> [↑](#footnote-ref-12)
13. <http://www.undp.org/content/dam/undp/library/corporate/Careers/P11_Personal_history_form.doc> [↑](#footnote-ref-13)
14. The Report length should not exceed *40* pages in total (not including annexes). [↑](#footnote-ref-14)
15. <http://www.unevaluation.org/document/detail/100> [↑](#footnote-ref-15)