**Management Response Template**

**Management response to the Midterm Review of SUCRE**

Project Title: Brazil Sugarcane Renewable Electricity

Project PIMS #: 3515

GEF Project ID (PMIS) #: 00064077

Midterm Review Mission Completion Date: June 2019

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**Context, background and findings**

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 among 80 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.

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.

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 and management response**

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| **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.** |
| **Management response:** Administrative action for request of extension before the donor is underway. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking[[1]](#footnote-1)** |
| **Comments** | **Status[[2]](#footnote-2)** |
| 1.1 CNPEM letter to request an extension of the Project deadline to December, 2020 | July 2019 | CNPEM | The letter was prepared and submitted to UNDP for submission to GEF | Partially Completed |

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| **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.**  |
| **Management response:** Actions have been taken to find groups related to the objectives of the project in order to perpetuate and disseminate the results. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 2.1 PAC meeting to discuss possibilities and suggestions on related subgroups. | June 2019 | CNPEM | To be held at CNPEM on 19, June 2019 | Completed |
| 2.2 Include new subgroups representatives in an extraordinary PAC meeting. | September 2019 | CNPEM |  | Pending |
| 2.3 Workshop between CNPEM/ Sucre team and subgroups representatives. | April 2020 | CNPEM |  | Pending |

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| **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.** |
| **Management response**: Sucre team in a partnership with UNICA are revisiting the Booklet and the suggestions for the sector regarding legal and regulatory framework. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 3.1 Update and distribution of the Booklet. | September 2019 | UNICA/CNPEM |  | Pending |
| 3.2 Meetings with main stakeholders which can help to launch adequations on legal and regulatory framework | December 2019 | UNICA/CNPEM |  | Pending |

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| **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.** |
| **Management response:** Wide academic dissemination has been implemented by the Sucre team on this subject. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 4.1 Special edition in the journal BioEnergy Research, with more than 10 papers regarding this issue. | July 2019 | CNPEM |  | Partially Completed |
| 4.2 Workshop on this subject | September 2019 | CNPEM |  | Pending |
| 4.3 Participation of Sucre team in international and national conferences on this topic | September 2019 to June 2020  | CNPEM |  | Pending |

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| **Increase efforts to involve other ministries, such as Mines and Energy (MME), Agriculture (MAPA) and Environment (MMA).** |
| **Management response:** Sucre team are trying to schedule meetings in the above-mentioned ministries in order to disseminate Sucre results. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 5.1 Oral presentation of the Sucre results on the Ministry of Agriculture, Livestock and Supply. |  Meeting held on June 27th 2019 | CNPEM/MCTIC |  | Completed |
| 5.2 Meeting to present project results on MME | September 2019 to December 2019 | CNPEM/UNICA/UNDP | Project Team needs UNICA and UNDP assistance to achieve this. | Pending |
| 5.3 Meeting to present project results on MMA | September 2019 to December 2019 | CNPEM/UNICA/UNDP | Project Team needs UNICA and UNDP assistance to achieve this. | Pending |

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| **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.****.**  |
| **Management response:** A wide study was made on this subject and results were presented in an international conference on biomass and are now under review in the Journal Land Use Policy. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 6.1 Oral presentation and paper published on the proceedings of the 25 European Biomass Conference. | June 2017 | CNPEM |  | Completed |
| 6.2 Submission of the scientific paper to a peer reviewed journal. | March 2019 | CNPEM |  | Completed |
| 6.3 Submission of a scientific paper showing that there are enough areas to sugarcane expansion with no need for deforestation or occupation of environmental relevant areas. | March 2019 | CNPEM |  | Completed |

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| **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.** |
| **Management response:** Sucre team has been working on disseminate results widely through the sucroenergetic sector not only in Brazil but in other countries that have sugarcane plantation and processing plants. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 7.1 Identification and contact with organizations in other countries such as Argentina, South Africa, Mauritius and Guatemala. | 2018 | CNPEM |  | Completed |
| 7.2 Efforts on the sign and implementation of cooperation agreements between Sucre and other organizations on the above-mentioned countries. | December 2019 | CNPEM |  | Pending |
| 7.3 Participation in the ISSCT Congress, in Argentina, with a plenary presentation of the project results. | September 2019 | CNPEM |  | Pending |

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| **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.** |
| **Management response:** A plan has been prepared in order to reach not only the sector stakeholders, but also the government players that can support the implementation of the suggestions on the adequation of the legal and regulatory framework. Thus, actions on Recommendation 3 also should be considered in recommendation 8. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 8.1 National Workshop to present all results. | December 2019 | CNPEM |  | Pending |
| 8.2 International Workshop to present all results. | September 2019 | CNPEM |  | Pending |

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| **Promote and participate national and international seminars for the broader dissemination of the Project experiences.** |
| **Management response:** Project team has been presenting results in several national and intentional events. Moreover, since the extension was approved, the team has plans to participate and to have stands in important biomass conferences worldwide. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 9.1 Participation on the Brazilian Bioenergy Science and Technology Conference. | March 2020 | CNPEM |  | Pending |
| 9.2 Participation and exhibition of the project results on the 28th European biomass Conference. | June 2020 | CNPEM |  | Pending |
| 9.3 Participation and exhibition of the project results in a Latin American conference to be defined soon. | April to December 2020 | CNPEM |  | Pending |

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| **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.**  |
| **Management response:** All the actions above are related to replication and dissemination of the project results. Moreover, Sucre team is working on the production of a simple and comprehensive material to support dissemination actions and to guarantee replication and perpetuation of the results. |
| **Key action(s)** | **Time frame** | **Responsible unit(s)** | **Tracking** |
| **Comments** | **Status** |
| 10.1 Preparation of a comprehensive material on the project results to be spread over national and international conferences and events. | December 2019 to April 2020 | CNPEM |  | Pending |
| 10.2 Inclusion of several mills on Batch 2. | January 2019 | CNPEM |  | Completed |
| 10.3 Release of tools for consultation and simple simulations regarding the use of sugarcane straw for electricity production. | December 2019 to June 2020 | CNPEM | Sucre Calculator, Sucre Databases and Sucre Site in Portuguese and English versions with possibility to download project documents. | Pending |

1. If the MTR is uploaded to the ERC, the status of implementation is tracked electronically in the Evaluation Resource Centre database (ERC). [↑](#footnote-ref-1)
2. Status of Implementation: Completed, Partially Completed, Pending. [↑](#footnote-ref-2)