BIOMASS COGENERATION PLANT BY SCOUL

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1 PROJECT DETAILS

1.1 Summary Description of the Project

The purpose of the project activity is to utilize available bagasse in SCOUL sugar factory for steam and electricity generation. The project undertaken is a cogeneration plants of capacity 30 MW (with 150TPH steam generation) located at Lugazi, Uganda. Bagasse based Cogeneration plant is supplying steam and electricity to the sugar mill and export the power surplus to the national grid.

The project activity isinvolve the installation of one module composed of one high-pressure boiler of 150 tonnes of steam per hour at 87 bar and 525 °C and one turbo-generator of 37.5 MVA corresponding to 30 MWe. The power plant isfueled with the bagasse left from the sugar mill process. Based PPA in between SCOUL and UETCL of 15 MW power is supplying by SCOUL to UETCL, maximum power it can supply upto 22 MW.

In the baseline situation, according to the forecast sugar production, the sugar mill continues to generate steam and power demand for onsite process purposes and no surplus of electricity is exported to the national grid. Therefore, in project activity PP will only claim emission reduction on power exported to grid because in baseline this power was taken from fossil fuel based grid. To date, sugar cane production is close to 1,400,000tonnes per year and will be progressively increased up to reach 1,650,000 tonnes per year for the sugar season 2025.
By exporting biomass-based electricity surplus to the national grid, the project activity is replacing the same amount of electricity otherwise generated in fossil fuel-based plants in the country. In this manner, the project is avoiding the emission of 18,861tCO_2e in average per year resulting in 188,610 tCO_2e during the 10 years crediting period. During the current monitoring period from 19/07/2021 to 31/12/2021 project is reducing 7,221 tCO_2e.

1.2 Sectoral Scope and Project Type

TYPE I – Energy Industries (Renewable/non-renewable sources)

ACM0006: Electricity and heat generation from biomass

The project activity falls under the Sectoral Scope 1: Energy industries (renewable - / non-renewable sources) as per the sectoral scopes defined by the CDM Executive Board.

This is not a grouped project as it does not involve combination of GHG projects or other project categories. It is a single project and there are no other project participants involved.

The purpose of the project activity is to utilize bagasse available in the SCOULsugar mill for Steam and electricity generation.

1.3 Project Eligibility

This project falls under the "Type I: Renewable energy projects" and "**ACM0006: Electricity and heat generation from biomass**" version 15. This project meets all the applicability criteria set under the selected approved large scale CDM methodology and hence the project category is applicable to the VCS project.

As per VCS standard version 4.3large scale biomass based power generation projects are eligible from LDC countries and Uganda is a LDC country since 1971 as per UN committee for Development Policy dated 24th Nov 2021[1].

1.4 Project Design

☒ The project includes a single location or installation only

☐ The project includes multiple locations or project activity instances, but is not beingdeveloped as a grouped project

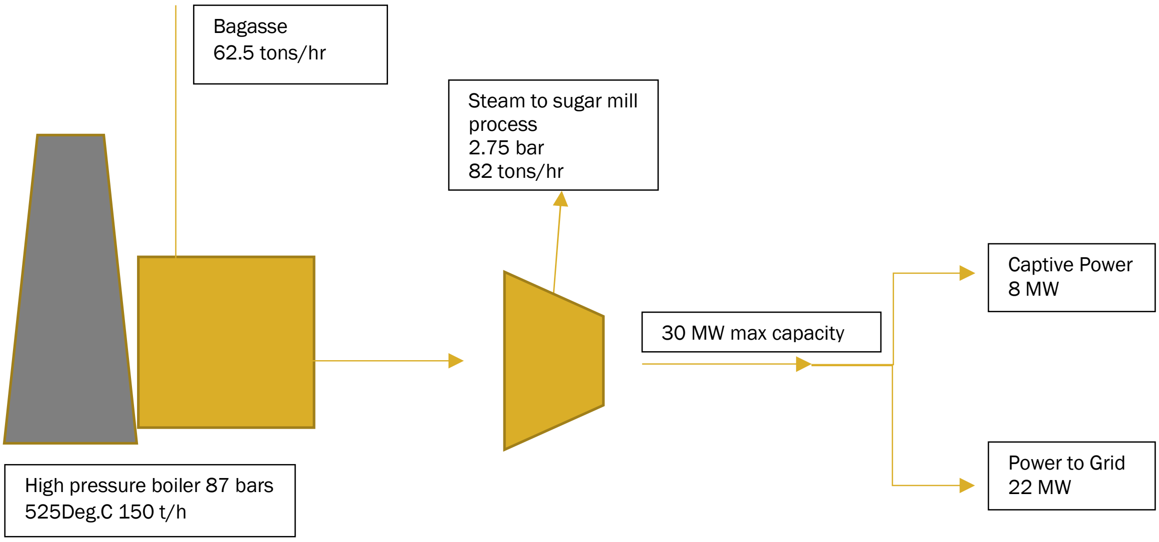
☐ The project is a grouped project

The project use the sugarcane bagasse obtained from the sugar mill and produce the total energy to cover the sugar factory process. In this manner, the current boilers and turbine is progressively uninstalled and all the energy generation is produced by the new project. The project aims also to export a large surplus of electricity into the national grid. A project activity of 37.5MVA corresponding to 30 MWe was installed on 19th July 2021 for an estimated gross power generation of 238 GWh/y. Phase I involved in installation of one high-pressure boiler of 150 tonnes of steam per hour at 87 bar and 525 °C.

The new cogeneration power planthave an efficiency of around 71.4%, which is similar to that one considered for the new boiler (boiler 3) from the baseline scenario. The new turbo have an efficiency of 4.96 kg of superheated steam per kilowatt-hour in multi-stage mode (crop season) and 3.82 kg/kWh in condensing mode (off-season). The project fuelled with the bagasse left from the sugar mill process.

The following figure summarizes the modular configuration of each project activity phase.

[1]https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/ldc_list.pdf



This is not a grouped project as it does not involve combination of GHG projects or other project categories. It is a single project and there are no other project participants involved.

Eligibility Criteria

This is not a group project. Therefore, this section is not applicable.

1.5 Project Proponent

Organization name	Sugar Corporation of Uganda Limited
Contact person	Vijay Dongare
Title	Deputy Chief Executive (Projects)
Address	P.O. Box 1, Lugazi, Uganda
Telephone	Tel : 256 312555500, +256 312555219, Fax : +256 312555248, Mob : +256 703444904
Email	vijaydongare@mehtagroup.com

Organization name	Enen Green Services Private Limited
Role in the project	Project participant

Contact person	Ruchika Sharma
Title	Ms.
Address	506,T4, RPS Savana, sector 88,Faridabad
Telephone	+91-9953935506
Email	enengreen@gmail.com

1.6 Other Entities Involved in the Project

NA

1.7 Ownership

Owner of the project activity is Sugar Corporation of Uganda Limited (SCOUL) and documents showing proof of title and ownership of the emission reductions are as follows:

- Certificate of Incorporation.
- Purchase order of Boilers.
- Power Purchase Agreement

1.8 Project Start Date

19/07/2021 is considered as commissioning date of boiler because on 19/07/2021 project starts supplying power to Uganda Electricity Transmission Company Ltd. (UETCL).

1.9 Project Crediting Period

First crediting period- 19/07/2021 to 18/07/2031

Project crediting period considered as10 years fixed

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☒<20,000 tCO_2e/year

☐20,000 – 100,000 tCO_2e/year

☐ 100,001 – 1,000,000 tCO_2e/year

☐>1,000,000 tCO_2e/year

Indicate the scale of the project (project or large project) and the estimated annual GHG emission reductions or removals for the project crediting period.

Project Scale	
Project	√
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
19/07/2021 - 31/12/2021	8,524
01/01/2022 - 31/12/2022	18,978
01/01/2023 - 31/12/2023	18,978
01/01/2024 - 31/12/2024	18,978
01/01/2025 - 31/12/2025	18,978
01/01/2026 - 31/12/2026	18,978
01/01/2027 - 31/12/2027	18,978
01/01/2028 - 31/12/2028	18,978
01/01/2029 - 31/12/2029	18,978
01/01/2030 - 31/12/2030	18,978
01/01/2031 - 18/08/2031	9,284
Total estimated ERs	188,610
Total number of crediting years (fixed)	10
Average annual ERs	18,861

1.11 Description of the Project Activity

Sugar Corporation of Uganda Ltd (SCOUL), Lugazi is operating sugar factory with a rated capacity of 3,500 tons cane processing per day. SCOUL is now planning to establish bagasse based cogeneration Project.

At present sugarcane processing at the rate of 200 tch (4600 TCD), the factory has surplus bagasse, which has no local market hence has no economic value. The surplus bagasse is not only costing lot of money for stock piling during season, fire protection etc, but also creating lot of concern on environmental protection. In addition, there is a potential for cane supply of about 1,400,000 tons per year.

Bagasse based co-generation plants are not only eco-friendly but also have added advantages of relatively low capital cost as well as short gestation period. With the continuous depletion of fossil fuels, growing population pressures and renewed concern for environment, co-generation in sugar industry has become one of the most convenient and environment friendly way of generating electricity. The world over, co-generation has been recognised as a reliable way of producing additional electricity.

As per the baseline scenario, the same quantity of sugar cane is processed and consequently, the same amount of bagasse for cogeneration purposes will be available. Concerning the use of fossil fuels, coal and gas could be also used in case of emergency, only in case of lack of biomass. The cogeneration plant has been designed considering these scenarios.

The project activity's technology and know-how are transferred from several sources:

- The consulting expertise is provided by internal resources and by experts with decades of experience in the sugarcane sector as well as the electricity generation sector.
- The equipment's technology comes from British and German manufacturers.
- The installation, operation and maintenance assistance are ensured by a highly qualified international EPC contractor company, assisted by own technical resources.

Installation and operation of the high efficiency cogeneration plant do not pose any environmental hazards. The technology of generating electricity through biomass residues combustion is environmentally safe and sound, as confirmed by the EIA.

The project activity entails the commissioning of a biomass-based Cogeneration Project.

Table 1: The key parameters of the Boiler

Make:	ISGEC Heavy Engineering Limited
Design capacity	150 TPH
Design pressure	87 bar
Steam temperature	525 ± 5 °C
Thermal Efficiency (%)	71.4%
Fuel used	Bagasse
Purchase date	19/04/2019
Life Span	30 years

Table 2: The key parameters of the Turbine are given below:

Make:	Shin Nippon Machinery Company ltd.

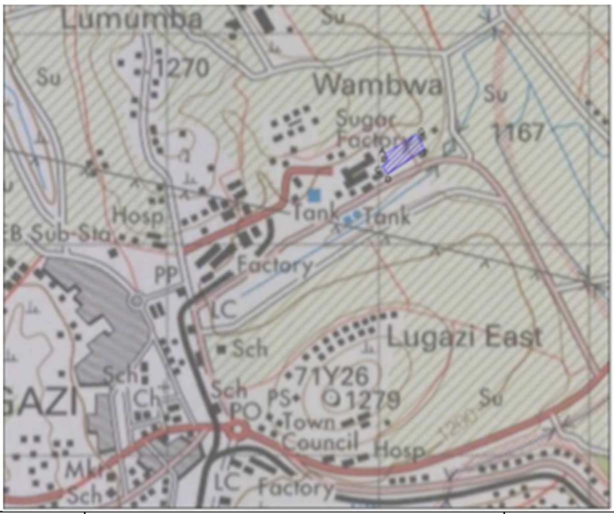
Manufacturer's Model no.	C9-R14-ER
Design capacity	30MW
Speed (turbine/generator)	4900/1500 rpm
Inlet Steam Temperature:	520°C
Inlet Steam Pressure:	85 bar
Exhaust steam pressure	0.10 bar
Purchase date:	18/04/2019
Life span	50 years

Bagasse ash contains potash, hence can be used as manure. In most of the sugar factories, it is being mixed with filter cake and is being used as manure in the cane fields.

The project does not involve any transfer of technology.

1.12 Project Location

Lugazi, Uganda



Mark	Latitude	Longitude
A	0º22’55.70’’N	32º56’49.31’’E
B	0º22’51.01’’N	32º56’50.03’’E
C	0º22’50.1’’N	32º56’48.77’’E
D	0º22’48.31’’N	32º56’49.92’’E
F	0º22’53.58’’N	32º56’58.77’’E
G	0º22’56.74’’N	32º56’57.44’’E

1.13 Conditions Prior to Project Initiation

The electricity demand of sugar mill was met by the grid supply and the steam demand was met by coal fired boilers. Coal was consumed in the pre project scenario for thermal energy generation. In pre project scenario PP was operating low pressure boiler and back pressure turbine. In pre project scenario power and steam generated, utilize for inhouse consumption only and additional power procure from grid. Therefore, in project scenario PP is claiming emission reduction on power supplied to national grid.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

Regulatory Analysis	Consistency with law and regulations?
As the project activity legal due diligence demonstrates, this alternative scenario complies with all mandatory applicable legal and regulatory requirements.	Yes
Current grid-connected power plants operate under the control and responsibility of the Uganda Electricity Transmission Company Ltd. (UETCL), a Government body in compliance with the law.	Yes
The biomass residues are used for power or heat generation at the project site in plant and	Yes

left to decay in aerobic conditions in the current sugarcane plantations: As the current sugar mill operation permits demonstrate, this alternative scenario complies with all mandatory applicable legal and regulatory requirements.	

Project activity received EIA approval from The National Environment Management Authority (NEMA) on 19/05/2016for establishment of co-generation plant and 33 kV power evacuation line from cogeneration plant to switch yard. EIA approval clarifies that co-generation power plant is meeting all requirements of EIA regulation 1998.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

Project activity not registered under any other GHG program.

1.15.2 Projects Rejected by Other GHG Programs

The project is not rejected under any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

The project is not included in any emission trading program or any other mechanism that includes GHG allowance tradingand include details about any such programs or mechanisms.

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

1.16.2 Other Forms of Environmental Credit

The Project has not created another form of environment credit till date.

Has the project sought or received another form of GHG-related credit, including renewable energy certificates?

☐ Yes ☒ No

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

The contributions of proposed project activity towards sustainable development are explained with indicators like social, economic, environmental and technological well-being, as follows:

Environmental well-being: The project activity will conserve decay of bagasse and help to mitigate emission of GHG (CH4, also project is reducing use of grid power.

Social well-being: The project activity will pave the way for development and increases the social status and living conditions and the prevailing living standard in the vicinity of the project activity and thus results in empowering the nearby population (supplier of the major amount of workforce for construction of the project activity).Also it will Contribute to a small increase in the local employment by employing skilled and un-skilled personnel for operation and maintenance of the equipment. This Proposed Project Activity will result in reduced migration of the local population.

Economic well-being: The project has created a business opportunity during construction phase for local stakeholders such as suppliers, contractors, bankers etc. contributing to economic well-being aspects. Further, the project also influences creation of employment opportunities for local people, which would enhance their social status. Also, it Saves the coal and HSD and thus allows it to be diverted to other needy sections of the economy.

Technological well-being: The project activity utilizes biomass as fuel to generate steam and electricity. It is an advanced and sustainable technology for long term benefits. The project activity is expected to increase awareness and interest among the industry players to make investments in similar areas.

1.17.2 Sustainable Development Contributions Activity Monitoring

In between 19/07/2021 to 31/12/2021, PP has supplied 52,788.24 MWh renewable power to national grid therefore it's directly contributing to SDG 7 Affordable and Clean Energy.

During current monitoring period PP has organized one skill development training on 10/07/2021 and 31/08/2021, in which they provided training to 120 persons, this training provided operation and maintenance of cogeneration plant as well as Cogen equipment technical support details.. Details of training are as follows:

Topic covered:

a) Bagasse Feeding system

b) Feedwater system

c) Boiler steam generation

d) Ash handling system

e) Turbine start up procedures

f) Enabling & Disabling steam extraction from turbine through governor & DSC

g) Cooling tower operation

h) Raw water management

i) Electrical power distribution

j) Energy monitoring system

As PP has providing skilled training to it's employees those who are employed from near by communities, this activity directly contributing to SDG 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" and directly impacting target 8.6 "By 2020, substantially reduce the proportion of youth not in employment, education or training".

PP has generated approx. 155 employments at local level and their salary details are given in appendix II. Through local employment PP is contributing to SDG 8 "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" and directly impacting target 8.6 "By 2020, substantially reduce the proportion of youth not in employment, education or training".

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.1.2	7.1.2 Proportion of population with primary reliance on clean fuels and technology	Implemented activities to increase	In between 19/07/2021 to 31/12/2021, PP has supplied 52,788.24 MWh renewable power to national grid.	The project will increase the clean energy and technology by supplying 1,377,272 MWh in 10 year period of it's lifetime.
2)	8.6,1	8.6,1 Proportion of youth (aged 15-24 years) not in education, employment and training	Implemented activities to decrease	PP has appointed 155 indigenous people to manage the project activity therefore Increase the employment.	Lowered the unemployment rate and generate 155 employments.
3)	8.6,1	8.6,1 Proportion of youth (aged 15-24 years) not in education, employment and training	Implemented activities to decrease	PP has provided skilled training to 120 person increase their technical and management skills. Only one training organized in monitoring period.	Lower the unskilled staff by providing training and improve their skills. PP will organize skilled training every year.
4)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	By implementation of project activity will reduce grid power dependency and reduce emission reduction 7,221tCO_2e during the monitoring period	Project activity will prevent release of approx. 188,610 tCO_2e into the atmosphere

1.18 Additional Information Relevant to the Project

Leakage Management

Scenarios for the use of biomass residues, as per the methodological tool "Project and leakage emissions from biomass" (Version 04.0):

B1	The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields;	Yes	B1 is a likely baseline scenario since biomass residues are used for cogeneration purposes and the remaining share is left to decay in aerobic conditions in the current sugarcane plantations.
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields;	No	Not applicable as the biomass residues are used for cogeneration purposes and the remaining share left to decay in the current sugarcane plantations.
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes;	No	Not applicable as the biomass residues are used for cogeneration purposes and the remaining share left to decay in aerobic conditions in the current sugarcane plantations.
B4	The biomass residues are used for energy or non-energy applications, or the primary source of the biomass residues and/or their fate cannot be clearly identified. For example, this scenario can be used if biomass residues are purchased from biomass processing plants which are not included in the project boundary.	No	Not applicable as the biomass residues are not purchased from any market, or the primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.
B5	The biomass residues are used for power or heat generation at the project site in new and/or existing plants;	Yes	B5 is a likely baseline scenario since bagasse residue are mainly used to cover the plant energy needs. This is usually the prevailing practice in similar countries and

			industries. At the time of PDelaboration no other category of biomass residues is considered in the baseline.

Leakage emissions due to diversion of biomass residues from other applications shall be calculated according to the methodological tool 16“Project and leakage emissions from biomass” version 5, as per para 52(e)(ii)Demonstrate for the sites from where biomass residues are sourced that the biomass residues have not been collected or utilized (e.g. as fuel, fertilizer or feedstock) but have been dumped and left to decay, land-filled, left in the field to decay after harvest, or burnt without energy generation (e.g. field burning). This approach is only applicable to biomass residues categories for which project participants can clearly identify the site from where the biomass residues are sourced;

➔In Project activity biomass residues sourced from PP owned sugar industry who is also placed at same location. In baseline scenario bagasse generated from sugar industry dumped in open land as there was no market for this bagasse in project region. Therefore, no leakage emission for biomass residues used in the Project activity. $LE_y = 0$.

2 SAFEGUARDS

2.1 No Net Harm

No negative environmental and socio-economic impacts was created on the environment. Thus, no net harm caused.

2.2 Local Stakeholder Consultation

Invitations for stakeholder consultation meeting were sent out by SCOUL via email and public notice. Stakeholders were identified as those whose activities directly or indirectly impact the project, and those who were to be impacted by the project activities.

PPhas organize stakeholder consultation meeting on 25/02/2022 in SCOUL Pentagon at 10 AM Lugazi, Uganda.

The meeting was attended by the grid authority representative, community members, Local government representative and local NGOs in the area. The objective of the meeting was to inform the stakeholders about the environmental and social impacts of the project activity and discuss their concerns regarding the same, if any. The comments and suggestions were invited throughout the period of Stakeholders meet.

The overall response to the project, from all invited stakeholders, was encouraging and positive. In all, no adverse reactions, comments, or clarifications were received during the Stakeholder Consultation process. The project participants did not recognize any need to make changes to the project design or monitoring plan. During the stakeholder consultation SCOUL share draft PD and MR with stakeholders.

Ongoing communication with stakeholders and interested parties is maintained through an open invitation of feedback and criticism. At the gate of SCOUL, a complaint and feedback register are kept for comments of stakeholders and to inform them back for action taken on the comments. A display is maintained to inform the purpose of the register and to encourage any feedback from stakeholders that they may like to convey to SCOUL. Up to the date of preparation of this report, there are no adverse comments from stakeholders regarding implementation of the project.

2.3 Environmental Impact

Project activity received EIA approval from The National Environment Management Authority (NEMA) on 19/05/2016 for establishment of co-generation plant and 33 kV power evacuation line from cogeneration plant to switch yard. EIA approval clarifies that co-generation power plant is meeting all requirements of EIA regulation 1998.

2.4 Public Comments

Ongoing communication with stakeholders and interested parties is maintained through an open invitation of feedback and criticism. At the gate of plant, a complaint and feedback register are kept for comments of stakeholders and to inform them back for action taken on the comments. A display is maintained to inform the purpose of the register and to encourage any feedback from stakeholders that they may like to convey to Sugar Corporation of Uganda Limited. Up to the date of preparation of this report, there are no adverse comments from stakeholders regarding implementation of the project.

Project was under public commenting period on VERRA webpage from 29/04/2022 to 29/05/2022 and no comments received during commenting period.

2.5 AFOLU-Specific Safeguards

This is a non-AFOLU project. Therefore, this section is not applicable.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The approved baseline and monitoring methodology applied in the proposed project activity is ACM0006 “Consolidated methodology for electricity and heat generation from biomass residues” Version 15.0.

In line with the application of the ACM0006 methodology, the project refers to the following tools:

- Combined tool to identify the baseline scenario and demonstrate additionality (Version 7.0)
- Tool to calculate the emission factor for an electricity system (Version 07.0)
- Project and leakage emissions from biomass (Version 5.0)

3.2 Applicability of Methodology

The approved consolidated baseline and monitoring methodology ACM0006 version 15.0 is applicable to biomass-residue (co-) fired power-and heat plants. The project activity includes: The installation of new plants at a site where currently power or heat generation occurs. The new plant replaces or is operated next to existing plants (capacity expansion projects).

S. No.	Applicability condition	Justification for project activity
1	Biomass used by the project facility is limited to biomass residues, biogas, RDF and/or biomass from dedicated plantations;	The project plant uses bagasse (by-product of sugar production), which is a biomass residue. No dedicated plantation activity involved in project activity.
2	Fossil fuels may be co-fired in the project plant. However, the amount of fossil fuels co-fired does not exceed 80% of the total fuel fired on energy basis;	No fossil use in project activity. The use of fossil fuel (coal or natural gas) has been envisaged only in case of emergency in case of lack of biomass.
3	For projects that use biomass residues from a production process (e.g. production of sugar or wood panel boards), the implementation of the project does not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process;	The implementation of the project does not result in an increase of the processing capacity of raw input or in other substantial change (identical volumes of resulting sugar production).
4	The biomass used by the project facility is not stored for more than one year;	The sugar cane bagasse will not be stored longer than a few months (minor volumes during off-season), this in order to guarantee enough bagasse to start the milling process the year after.
5	The biomass used by the project facility is not obtained from chemically or biologically (e.g. through esterification, fermentation, hydrolysis, pyrolysis, bio-or chemical degradation etc) prior to combustion. Thermal degradation, drying and mechanical processing, such as shredding and pelletisation are allowed.	No chemical process is involved in the biomass preparation prior to combustion. It is directly fed from the crushing mills exit to the boilers. .
6	In the case of fuel switch project activities, the use of biomass residues or the increase in the use of biomass residues as compared to the baseline scenario is technically not possible at the project site without a capital investment in: • The retrofit or replacement of existing heat generators/boilers; or • The installation of new heat generators/boilers; or • A new dedicated biomass supply chain established for the purpose of the project	Not applicable as no fuel switch is at stake.

	(e.g. collecting and cleaning contaminated new sources of biomass residues that could otherwise not be used for energy purposes); or • Equipment for preparation and feeding of biomass residues.	
7	If biogas is used for power and/or heat generation, the biogas must be generated by anaerobic digestion of wastewater, and: • If the wastewater generation source is registered as a CDM project activity, the details of the wastewater project shall be included in the PDD and emissions reductions from biogas energy generation are claimed using this methodology; • If the wastewater source is not a CDM project, the amount of biogas does not exceed 50% of the total fuel fired on energy basis.	Not applicable as no biogas is recovered for power or heat generation.
8	In the case biomass from dedicated plantations are used the applicability conditions of the methodology tool “project and leakage emissions from biomass” apply.	No dedicated plantation involved in project activity as PP is using bagasse waste from sugar industry.

As per methodology

- For power generation: Scenarios P1, P5 and P7.
- For heat generation: Scenarios H1 and H5.
- For biomass residue use: Scenarios B1 and B5.

It is to be noted that the project activity does not include the generation of mechanical power through steam turbines, or the use of biogas from on-site wastewater. Thusthescenarios M1 to M5 and BG1 to BG5 does not apply.

Finally, the project activity complies with all the applicability criteria of the tools referred in the ACM0006 methodology.

Conclusion: the proposed project activity meets all the applicability conditions of the version 15.0 of ACM0006 methodology.

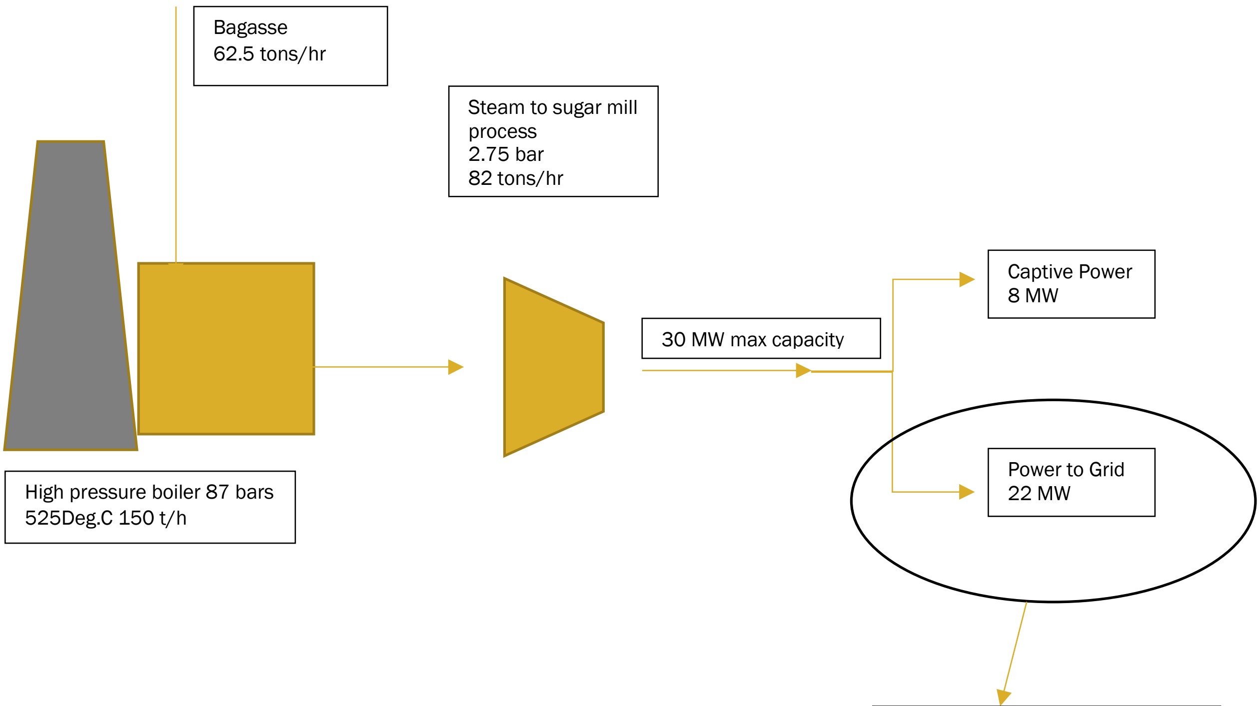
Sr No.	Tool	Applicability with Project activity
1.	Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)	According to ACM0006 version 15 methodology, the selection of the baseline scenario should be conducted by applying the “Combined tool to identify the baseline scenario and demonstrate additionality”, thus

		PP has demonstrated applicability of tool in section 3.4 below.
2.	Tool to calculate the emission factor for an electricity system (Version 07.0)	Project activity has adopted UNFCCC standardisedbaseline for grid emission factor calculation[2].
3.	Project and leakage emissions from biomass (Version 5.0)	No dedicated plantation involved in project activity as PP is using bagasse waste from sugar industry. Therefore this tool will not be applicable.

3.3 Project Boundary

PP considered project boundary only power plants connected physically to the electricity system (grid) that the project plant is connected to. Because in baseline plant was generating power and heat.

Project Boundary



As shown in the following table, the emissions sources and the GHG invol solely encompass the carbon dioxide (CO2) saved from displaced fos

[2]https://cdm.unfccc.int/methodologies/standard_base/2015/sb45.html

electricity generation. Methane (CH4) or Nitrous Oxide (N2O) emissions not considered as there is no dedicated plantation.

Source		Gas	Included?	Justification/Explanation
Baseline	Electricity and heat generation	CO_2	Included	Main Emission source.
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
		Other	Excluded	-
	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	It is assumed that CO2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector
		CH_4	Excluded	For conservativeness reasons, project participants decided not to include this emission source.
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources
		Other	Excluded	-
Project	On site fossil fuel and electricity consumption due to the project activity (stationary or mobile)	CO_2	Included	The emission due to onsite fossil fuel consumption attributable to the project activity has been included in the project activity
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
		Other	Excluded	-
	Grid electricity generation	CO_2	Included	Main Emission source.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Off site Transportation of biomass residues	CO_2	Excluded	Excluded for simplification.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.

Source		Gas	Included?	Justification/Explanation
	Combustion of biomass residues for electricity and/or heat generation	CO_2	Excluded	Does not apply to the project activity as there is no uncontrolled burning or decay of biomass residues that would lead to GHG emissions
		CH_4	Excluded	
		N_2O	Excluded	
		Other	Excluded	
	Storage of biomass residues	CO_2	Excluded	Does not apply to the project activity as the biomass residues storage period is less than one year.
		CH_4	Excluded	
		N_2O	Excluded	

3.4 Baseline Scenario

According to ACM0006 methodology, the selection of the baseline scenario should be conducted by applying the “Combined tool to identify the baseline scenario and demonstrate additionality”, thus the following steps are applied:

Step 1: Identification of alternative scenarios

This step serves to identify all alternative scenarios to the proposed project activity(s) that can be the baseline scenario through the following sub-steps:

Step 1a: Define alternative scenarios to the proposed project activity

Identify realistic alternative scenarios that are available to the project participants and that provide outputs or services with comparable quality, properties and application areas as the proposed project activity, i.e. heat and power production for the sugar mill facilities.

The project activity does not include the generation of mechanical power through steam turbines, or the use of biogas from on-site wastewater, thus, these scenarios have not been considered.

Alternative scenarios for electric power:

Description of alternative scenarios		Plausible and credible alternative?	Rationale
P1	The proposed project activity not undertaken as a CDM project activity.	Yes	Project activity is feasible although not likely to occur without carbon financing.
P2	If applicable, the continuation of power generation in existing power plants at the	No	P2 is not plausible baseline scenario, as the old turbineof 9.5 MW (6+3.5

	project site; The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the starting date of the project activity;		MW)wouldbe replaced by a new one of 30 MW, which will cover the onsite power demand. Indeed, the continuation of power generation in the existing turbine at the project site is not a realistic scenario as its power capacity is not enough to meet the onsite power requirements based on the forecast sugar cane production.
P3	If applicable, the continuation of power generation in existing power plants at the project site. *The existing plants would operate with different conditions from those observed in the most recent three years prior to the starting date of the project activity;*	No	P3 is not plausible baseline scenario, as the old turbine of 9.5 MW (6+3.5 MW)would be replaced by a new one of 30 MW, which will cover the onsite power demand. Indeed, the continuation of power generation in the existing turbine at the project site is not a realistic scenario as its power capacity is not enough to meet the onsite power requirements based on the forecast sugar cane production. Old turbine 9.5 MW not in operation now.
P4	If applicable, the retrofitting of existing power plants at the project site; *The retrofitting may or may not include a change in fuel mix;*	No	The retrofitting of the 9.5 MW (6+3.5 MW) turbine is not a realistic scenario since in the baseline the electricity demand exceeds installed capacity. As stated above, during the baseline this unit is replaced by a new one of 30 MW which covers the onsite power demand.
P5	The installation of new power plants at the project site different from those installed under the project activity;	Yes	P5 is a plausible baseline scenario as a new turbine of 30 MW would be installed in

			order to replace the current one and meet the onsite power requirements according to the forecasted sugar cane production.
P6	The generation of power in specific off-site plants, excluding the power grid;	No	Not credible as there are no off-site plants neither existing nor planned to be built near the project site.
P7	The generation of power in the power grid.	Yes	Feasible considering that the Sugar mill is connected to the national grid although in the baseline situation the factory entirely covers its power demand. In the absence of the project activity, no electricity is exported into the grid and consequently other plants which are mainly based on fossil fuel would have generated the same power into the grid.

Alternative scenarios for heat:

Description of alternative scenarios		Plausible and credible alternative?	Rationale
H1	The proposed project activity not undertaken as a CDM project activity.	Yes	Project activity is feasible although not likely to occur without carbon financing. PP is not considering heat generation under project activity because baseline turbine was also generating heat.
H2	If applicable, the continuation of heat generation in existing plants at the project site; *The existing plants would operate at the same conditions (e.g. installed capacities, average load factors, or average energy efficiencies, fuel mixes, and equipment configuration) as those observed in the most recent three years prior to the*	No	H2 is not a plausible baseline scenario, since in the absence of the project the existing plant will operate with different conditions to those observed in the most recent three years prior to the starting date of the project activity.

	starting date of the project activity;		
H3	If applicable, the continuation of heat generation in existing plants at the project site. The existing plants would operate with different conditions from those observed in the most recent three years prior to the CDM project activity;	No	H3 is not plausible scenario as a new boiler is installed in absence of the project activity in order to meet the sugar mill heat demand.
H4	If applicable, the retrofitting of existing plants at the project site; *The retrofitting may or may not include a change in fuel mix;*	No	In the absence of the project activity, the current heat capacity is increased through the installation of a new boiler of 150 TPH and all the sugar mill heat requirements are covered. Under this scenario all the installed boilers continue to operate without any retrofitting. H4 is not a realistic scenario.
H5	The installation of new power plants at the project site different from those installed under the project activity;	Yes	H5 is a plausible baseline scenario as in addition to the current boilers, a new one of 150 TPH would be installed in order to increase the heat-installed capacity and cover sugar mill requirements according to the forecasted sugar cane production.
H6	The generation of heat in specific off-site plants;	No	Not credible as there is no off-site heat-generating plants neither existing nor planned to be built near the project site.
H7	The use of heat from district heating.	No	There is no district heating available in Uganda.

Alternative scenarios for the use of biomass residues, as per the methodological tool “Project and leakage emissions from biomass” (Version 05.0):

Description of alternative scenarios		Plausible and credible alternative?	Rationale
B1	The biomass residues are dumped or left to decay mainly under aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields;	Yes	B1 is a likely baseline scenario since biomass residues are used for cogeneration purposes and the remaining share is left to decay in aerobic conditions in the current sugarcane plantations.
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to landfills which are deeper than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields;	No	Not applicable as the biomass residues are used for cogeneration purposes and the remaining share left to decay in the current sugarcane plantations.
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes;	No	Not applicable as the biomass residues are used for cogeneration purposes and the remaining share left to decay in aerobic conditions in the current sugarcane plantations.
B4	The biomass residues are used for energy or non-energy applications, or the primary source of the biomass residues and/or their fate cannot be clearly identified. For example, this scenario can be used if biomass residues are purchased from biomass processing plants which are not included in the project boundary.	No	Not applicable as the biomass residues are not purchased from any market, or the primary source of the biomass residues and/or their fate in the absence of the project activity cannot be clearly identified.
B5	The biomass residues are used for power or heat generation at the project site in new and/or existing plants;	Yes	B5 is a likely baseline scenario since bagasse residues are mainly used to cover the plant energy needs. This is usually the prevailing practice in similar countries and industries. At the time of PDD elaboration no other category of biomass residues is considered in the baseline.

The baseline scenario for the use of biomass residues should be separately identified for different categories of biomass residues, covering the whole amount of biomass residues supposed to be used in the project activity during the crediting period, and consistent with the alternative scenarios selected for power and heat generation (scenarios P and H above):

Biomass residues category (*k*)	Biomass residues type	Biomass residues source	Biomass residues fate in the absence of the project activity	Biomass residues use in project scenario
1	Cane bagasse	On-site production	Power and heat generation on-site (B5)	Power and heat generation on- site (cogeneration)
		On-site production	Left to decay in aerobic conditions in the current sugarcane plantations (B1)	Power and heat generation on- site (cogeneration)

Outcome of Step 1a: List of plausible alternative scenarios to the project activity

Following the above analysis, the plausible alternative scenarios further considered are:

- For power generation: P1, P5 and P7
- For heat generation: H1 and H5
- For biomass residues: B1 and B5

Sub-step 1b: Consistency with mandatory applicable laws and regulations

The plausible alternative scenarios must be in compliance with all mandatory applicable laws and regulatory requirements. A review of their consistency with these laws and regulations is presented hereafter.

	Regulatory Analysis	Consistency with law and regulations?
P1, H1	As the project activity legal due diligence demonstrates, this alternative scenario complies with all mandatory applicable legal and regulatory requirements.	Yes
P7	Current grid-connected power plants operate under the control and responsibility of the Uganda Electricity Transmission Company Ltd. (UETCL), a Government body in compliance with the law.	Yes
B1, B5	The biomass residues are used for power or heat generation at the project site in plant and left to decay in aerobic conditions in the current sugarcane plantations: As the current sugar mill operation permits demonstrate, this alternative scenario complies with all mandatory applicable legal and regulatory	Yes

	requirements.	

Outcome of Step 1b: List of alternative scenarios to theproject activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country.

Following the above analysis, the plausible alternative scenarios compliant with mandatory legislation and regulations in force in Uganda are:

- For power generation P1, P5 and P7
- For heat generation: H1 and H5
- For biomass residues: B1 and B5

Hence the following credible combinations of baseline scenarios still under consideration at this stage:

Baseline scenario			
Power	Heat	Biomass residues	Description of the situation
P1	H1	B5	The proposed project activity, **not undertaken as a** project activity: • The installation of a high efficiency biomass residues co-generation plant to generate extra power for greater autonomy and export to the grid. • The biomass residues are used for power or heat generation at the project site in the project activity plant.
P5, P7	H5	B1, B5	A low-medium efficiency, common practice cogeneration plant: • The heat and power generation to cover the entire sugar mill according to forecast sugar cane production. • There is no surplus of electricity delivered to the national grid. • The biomass residues are used for power or heat generation at the project site and left to decay in aerobic conditions on the current sugarcane plantations.

According to the "Combined tool to identify the baseline scenario and demonstrate additionality":

If there is only one alternative scenario that is not prevented by any barrier, and if this alternative is not the proposed project activity undertaken without being registered as a project activity, then **this alternative scenario is identified as the baseline scenario.**

Therefore, the baseline scenario is identified as the only alternative scenario that is not prevented by any barrier: a low-medium efficiency, business-as-usual cogeneration plant.

3.5 Additionality

The applied methodology requires the project participant to apply the latest approved version of the "Tool for the demonstration and assessment of additionality" (Version 07.0.0) in addition to the procedure mentioned in the methodology.

<u>Step0: Demonstration whether the proposed project activity is the first-of-its-kind</u>

The PP has demonstrated that the proposed project activity is a first-of-its-kind project activity as per "Tool 23: Methodological tool: Additionality of First-of-Its-Kind Project Activities" version 3.

Identifying the applicable geographical area:

As per the tool 23 para 12 (a), applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier.

The project activity covers the entire host country as a default. Project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions. For the project activity, the relevant sectors identified were the renewable energy sector and the sugar sector. A review of the policies concerning these industries indicates that these sectors are governed at a country level and hence varies considerably throughout Uganda. Sugar is one of the essential items in Uganda and Uganda is largest producer of granular brown sugar in the east African community. As the industry in general is controlled by the government and the use and promotion of renewable energy is also managed at a country level, the region for the 'First of its Kind' assessment has been selected as the country where the project activity has been implemented, i.e.Uganda.

Project activity involves the implementation of a high pressure boiler and the baseline involves the implementation of a low pressure boiler with lower efficiency. The project activity is a first instance of the implementation of the particular technology in the identified geographical region. In Uganda no sugar industry have commissioned 87 bar high pressure boiler based on bagasse as a input fuel. Hence project activity is a first of it's kind activity in the geographical region.

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

Sub-step 1a: Define alternatives to the project activity:

The identification of the realistic and credible alternatives to the project activity, consistent with the current laws and regulations, has been detailed in Section 3.4. The plausible alternatives thus identified for power, biomass and heat are provided below:

Power - P4 and P5- The installation of new power plants at the project site different from those installed under the project activity and the Generation of Power in the power grid. Heat:

H5- Generation of heat using biomass residues

Biomass- B1 and B4- Biomass residues is either dumped and left to decay aerobically or used to generate heat and power

Outcome of Step 1a: Identified realistic and credible alternative scenario(s) to the project activity

Sub-step 1b: Consistency with mandatory laws and regulations

All the above identified scenarios are in compliance with the applicable legal and regulatory requirements.

Outcome of Step 1b: Identified realistic and credible alternative scenario(s) to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the country and EB decisions on national and/or sectoral policies and regulations.

Step 2: Investment Analysis

In order to demonstrate the additionality, an Investment Analysis has been conducted between the identified baseline scenario and the project activity scenario without carbon financing. The list of assumptions used for the investment comparison analysis between the baseline reference plant and the project activity plant has been provided in Appendix I.

The reference plant design parameters has been detailed in Appendix I. This step has been implemented following the guidance provided in Step 2 of the latest version of the "Tool for the demonstration and assessment of additionality".

Sub-step 2a: Determine appropriate analysis method

As per paragraph 19 if the "GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS", Version (05, EB 62), "If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used. If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate."

In the proposed project activity, the project participant has identified a reference co-generation plant that would have been set up in the absence of the project activity. Therefore, even in the absence of the proposed carbon project, the project participant would have made an investment

to set up the baseline reference plant. Therefore, as per the guidance, benchmark analysis has not been considered appropriate and the project participant has demonstrated additionality through investment comparison analysis.
Sub-step 2b: As the project participant has chosen investment comparison analysis to demonstrate the additionality, Option II under the tool is applicable.
The proposed project activity involves the setting up of a biomass based co-generation plant that would meet the captive thermal and electrical energy requirements at the project site. The project activity also includes a source of revenue through sale of power to the regional grid. Therefore, in the context of decision making and for demonstration of additionality, Internal Rate of Return (IRR) has been used as the financial indicator.
Sub-step 2c: Calculation and comparison of financial indicators Based on the listed set of the assumptions, the IRR for the project activity works out to be 16.37% while the IRR for the reference plant works out to be 24.27%. Thus, in the absence of carbon project, the project participant could have opted to setup the low efficiency reference plant. However, considering the additional revenues that could be generated through the sale of carbon credits, the PP has decided to proceed ahead with the implementation of the project activity.
Sub-step 2d: Sensitivity analysis
The key parameters which are likely to impact the IRR are a) the Project cost, b) Cost of biomass, NCV of biomass, c) Plant Load Factor and d) Efficiency for the reference plant and the project activity power plant. The result of +/- 10% variation in the project cost on the IRR is provided in tabular format below:

Parameter	Variation	Revised Value	Unit	Revised IRR
Project Cost of Reference Plant	0%	43	million USD	24.27%
Project Cost of Project Plant	0%	43	million USD	16.37%
Biomass Price in Baseline Scenario	0%	30	USD/Ton	24.27%
Biomass Price in Project Scenario	0%	30	USD/Ton	16.37%
Tariff Escalation in Baseline Scenario	0%	10.00%	%	24.27%
Tariff Escalation in Project Scenario	0%	10.00%	%	16.37%
PLF in Baseline Scenario	0%	95%	%	24.27%
PLF in Project Scenario	0%	95%	%	16.37%
Calorific Value in Baseline Scenario	0%	3000	kCal/kg	24.27%
Calorific Value in Project Scenario	0%	3000	kCal/kg	16.37%
Steam to Fuel Ratio for Reference Plant	0%	2.4	Tons/ Tons	24.27%
Steam to Fuel Ratio for Project Plant	0%	2.25	Tons/ Tons	16.37%

Parameter	Variation	Revised Value	Unit	Revised IRR
Project Cost of Reference Plant	10%	47	million USD	21.52%
Project Cost of Project Plant	10%	47	million USD	16.42%
Biomass Price in Baseline Scenario	10%	33	USD/Ton	21.52%
Biomass Price in Project Scenario	10%	33	USD/Ton	16.42%
Tariff Escalation in Baseline Scenario	10%	11.00%	%	21.52%
Tariff Escalation in Project Scenario	10%	11.00%	%	16.42%
PLF in Baseline Scenario	10%	105%	%	21.52%
PLF in Project Scenario	10%	105%	%	16.42%

Calorific Value in Baseline Scenario	10%	3300	kCal/kg	21.52%
Calorific Value in Project Scenario	10%	3300	kCal/kg	16.42%
Steam to Fuel Ratio for Reference Plant	10%	2.64	Tons/ Tons	21.52%
Steam to Fuel Ratio for Project Plant	10%	2.475	Tons/ Tons	16.42%

Parameter	Variation	Revised Value	Unit	Revised IRR
Project Cost of Reference Plant	-10%	38.29	million USD	27.60%
Project Cost of Project Plant	-10%	38.29	million USD	16.31%
Biomass Price in Baseline Scenario	-10%	27	USD/Ton	27.60%
Biomass Price in Project Scenario	-10%	27	USD/Ton	16.31%
Tariff Escalation in Baseline Scenario	-10%	0.0	%	27.60%
Tariff Escalation in Project Scenario	-10%	0.00	%	16.31%
PLF in Baseline Scenario	-10%	0.86	%	27.60%
PLF in Project Scenario	-10%	0.86	%	16.31%
Calorific Value in Baseline Scenario	-10%	2700	kCal/kg	27.60%
Calorific Value in Project Scenario	-10%	2700	kCal/kg	16.31%
Steam to Fuel Ratio for Reference Plant	-10%	2.16	Tons/ Tons	27.60%
Steam to Fuel Ratio for Project Plant	-10%	2.03	Tons/ Tons	16.31%

As can be seen from the above table, even with a variation ± 10%, in all the key parameters, the IRR for the project plant remains below that of the reference plant. The only identified case wherein the IRR for the reference falls below that of the project plant is when the steam to fuel ratio for the reference plant belowto 2.16. However, this scenario is unrealistic. Thus it may be concluded that the project activity is financially less attractive as compared to the reference plant. However, the project participant has decided to proceed ahead with the implementation of the project considering carbon funds.

Outcome of Step 2: As per the sensitivity analysis, it is concluded that the proposed project activity is not the most financially/economically attractive option for the project participant.

Sub-step 3a: Identify barriers that would prevent the implementation of alternative scenarios

Detailed below are the proposedproject activity: The identified barrier that would prevent the implementation of the project activity in the absence of carbon credit is the Lack of prevailing practice. The project activity involves consumption of biomass for the generation of heat and power. The heat thus generated is used in the sugar manufacturing process. The power generated would also be used to meet the power demand of the sugar plant and the surplus power is planned to be exported to the grid. The high power generation and export to the grid has been possible due to the employment of a highly efficient technology. The boiler proposed to be implemented as a part of the project activity is a87 bar pressure boiler.

Outcome of Step 3a The identified barrier is lack of prevailing practice.

Sub Step 3b: Eliminate alternative scenarios which are prevented by the identified barriers

The above listed barriers prevent the implementation of the project activity in the absence of carbon financing. However, these barriers do not prevent the implementation of the identified baseline scenario, i.e., implementation of a reference plant with low efficiency, as it is the most common practice followed by the industry.

Outcome of Step 2b: The list of alternative scenarios that are not prevented by the prevailing practice barrier For Power: P5: The generation of heat in a new cogeneration plant at the project site P7: The generation of power in the power grid For Heat: H5: The generation of heat in a new cogeneration plant at the project site; For Biomass: B1: The Biomass residues are dumped or left to decay mainly under aerobic conditions. This applies for example, to dumping and decay of biomass residues on fields. B4: The biomass residues are used for power or heat generation at the project site in new and/or existing plants Thus, the only remaining alternative for the project is the implementation of a baseline reference plant with a lower efficiency.

As per the applied methodology, if there is only one alternative scenario that is not prevented by any barrier, and if this alternative is not the proposed project activity undertaken without being registered as a VCS project activity, then this alternative scenario is identified as the baseline scenario. From the above discussion it can be concluded that the baseline for the project would be the implementation of the baseline reference plant with lower efficiency.

Step 4: Common Practice Analysis

This step is justify whether "If similar activities to the proposed project activity are identified, then compare the proposed project activity to the other similar activities and assess whether there are essential distinctions between the proposed project activity and the similar activities".

The common practice analysis has been conducted as per the guidance provided in Tool 24: Methodological tool: Common Practice, version 3.1

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The proposed project activity is a 30 MW bagasse based cogeneration plant. As per the requirement of step 1, the applicable output range works out to ±50% of the rated output of the project plant (30 MW). The applicable output range, is therefore, 15 MW – 45 MW.

*Step 2:*identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

(a) The projects are located in the applicable geographical area;
(b) The projects apply the same measure as the proposed project activity;
(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;
(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;
(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;
(f) The projects started commercial operation before the project design document is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity

Selection of applicable geographical area:

Project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions. For the project activity, the relevant sectors identified were the renewable energy sector and the sugar sector. A review of the policies concerning these industries indicates that these sectors are governed at a country level and hence varies considerably throughout Uganda. Sugar is one of the essential items in Uganda and Uganda is largest producer of granular brown sugar in the east African community.

As the industry in general is controlled by the government and the use and promotion of renewable energy is also managed at a country level, the region for the 'project activity has been selected as the country where the project activity has been implemented, i.e.Uganda.

The list of projects that started commercial operation before the start date of the project includes[3]:

Company	Location	Capacity (MW)	Date of commissioning	Plant details
Kakira Sugars Ltd	Jinja, Uganda	52MW (22MW + 30MW)	2008 & 2012	100 TPH (2X50) boiler, 45 bar 160 TPH, 67 bar
Kinyara Sugar works limited	Masindi, Uganda	14.5 (1+1+7.5+5) MW	2015	Boiler 1 and bolier 2- 35 TPH 24 bar, Bolier 3-42 TPH 24 bar Boiler 4-48 TPH 24 bar
Sugar and Allied Industries Uganda limited	Kaliro, Uganda	11.9 MW	2014	110 TPH boiler, 45 bar
Mayuge Sugar Limited	Mayuge, Uganda	9.2 MW	2018	90 TPH boiler, 45 bar

Step 3: within the projects identified in Step 2, identify those that are neither registered under CDM or any carbon registry as project activities, nor project activities undergoing validation. Note their number Nall.

Therefore, N_{all} = 4

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. 4 project activity listed above are different from current project activity because above listed project activities are low pressure boilers whereas project activity commissioned high pressure boiler. Note their number N_{diff}.

Therefore, Ndiff = 4

[3]https://www.era.go.ug/index.php/stats/generation-statistics/energy-generated-by-utility

Step 5: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity

F = 1-4/4 = 1-1 = 0

The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and Nall-Ndiff is greater than 3.

As F = 0 (<0.2), the proposed project activity is not a common practice in the sector in the applicable area.

A review of the operational sugar plants reveal that the common practice in the region is to set up cogeneration plants with low pressure boilers. The most common configuration is setting up of lower pressure boilers. No activities similar to the project activity, ie. High pressure Boilers with 87 bar pressure has been observed. Therefore there is no scope of comparison with similar activities. Hence the proposed project activity is additional.

3.6 Methodology Deviations

PP has taken no deviation from methodology.

4 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 BaselineEmissions

Baseline emissions are calculated as follows:

$$BE_y = EL_{BL,GR,y} \times EF_{EG,GR,y} + \sum_f FF_{BL,HG,y,f} \times EF_{FF,y,f} + EL_{BL,FF/GR,y} \times min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}$$

Equation (1)

Where:

BE_y	=	Baseline emissions in year *y* (t CO_2)
$EL_{BL,GR,y}$	=	Baseline electricity sourced from the grid in year *y* (MWh)
$EF_{EG,GR,y}$	=	Grid emission factor in year *y* (t CO_2/MWh)
$FF_{BL,HG,y,f}$	=	Baseline fossil fuel demand for process heat in year *y* (GJ)
$EF_{FF,y,f}$	=	CO_2 emission factor for fossil fuel type *f* in year *y* (t CO_2/GJ)
$EL_{BL,FF/GR,y}$	=	Baseline uncertain electricity generation in the grid or on-site or off-site power-only units in year *y* (MWh)
$EF_{EG,FF,y}$	=	CO_2 emission factor for electricity generation at the project site or off-site plants in the baseline in year *y* (t CO_2/MWh)
$BE_{BR,y}$	=	Baseline emissions due to disposal of biomass residues in year *y* (t CO2e)

f	=	Fossil fuel type

Step 1: Determine the total baseline process heat generation *($HC_{BL,y}$)*, electricity generation and capacity constraints, and efficiencies

Step 1.1: Determine the total baseline process heat generation

The amount of process heat that would be generated in the baseline in year *y* ($HC_{BL,y}$) is determined as the difference of the enthalpy of the process heat (steam or hot water) supplied to process heat loads in the project activity minus the enthalpy of the feed-water, the boiler blow-down and any condensate return to the heat generators.

PP is not considering heat generation part for ER estimation.

Step 1.2: Determine the baseline capacity of electricity generation *($CAP_{EG,total,y}$)*

$$CAP_{EG,total,y} = LOC_y \times \left[\sum_i \left(CAP_{EG,CG,i} \times LFC_{EG,CG,i}\right) + \sum_j \left(CAP_{EG,PO,j} \times LFC_{EG,PO,j}\right)\right] \quad \text{Equation (2)}$$

Where:

$CAP_{EG,total,y}$	=	Baseline electricity generation capacity in on-site and off-site plants in year y (MWh)
$CAP_{EG,CG,i}$	=	Baseline electricity generation capacity of cogeneration-type heat engine *i*(MW)
$CAP_{EG,PO,j}$	=	Baseline electricity generation capacity of power-only-type heat engine *j* (MW)
$LFC_{EG,CG,i}$	=	Baseline load factor of cogeneration-type heat engine *i*(ratio)
$LFC_{EG,PO,j}$	=	Baseline load factor of power-only-type heat engine *j* (ratio)
LOC_y	=	Operation of the industrial facility using the process heat in year *y* (hour)
i	=	Cogeneration-type heat engine in the baseline scenario
j	=	Power-only-type heat engine in the baseline scenario

Step 1.3: Determine the efficiencies of heat generators, and efficiencies and heat-to-power ratio of heat engines

Heat Generators

According to the methodology, different options can be used to determine the heat generators efficiency. The following considerations have been taken:

- Option 1 (Default values): for the new boiler that would be constructed and operated at the project site in the baseline scenario

➔ A value of 89% has been used for the boiler of 150 TPH to be installed. This value is also comparable to the project activity boiler efficiency value.

- Option 2 (Manufacturer's data): for the current installed boilers, which have been in operation prior to the implementation of the project activity. This option is applicable since heat engines and heat generators were operated at the project site prior to the implementation of the project activity (no new equipment would be constructed and operated at the project site in the baseline scenario). The efficiency of the heat generator or heat engine is determined based on manufacturer's data of the efficiency under optimal operating conditions and take into account the actual conditions of the fuel used (including moisture content of biomass residues).

➔Boiler, have an efficiency of 80% respectively. As practical and conservative approach, the highest value of 80% has been used for both boilers in the heat baseline emissions calculation.

PP is not considering heat generation part for ER estimation.

Step 2: Determine the baseline electricity generation in the grid and emission factors

Step 2.1: Determine the baseline electricity generation *($EL_{BL,y}$)*

The amount of electricity that would be generated in the baseline in year *y* equals the amount of electricity generated in the project scenario as follows:

$$EL_{BL,y} = EL_{PJ,gross,y} + EL_{PJ,imp,y} - EL_{PJ,aux,y}$$ Equation (3)

Where:

$EL_{BL,y}$	=	Baseline electricity generation in year *y* (MWh)
$EL_{PJ,gross,y}$	=	Gross quantity of electricity generated in all power plants included in the project boundary in year *y* (MWh)
$EL_{PJ,imp,y}$	=	Project electricity imports from the grid in year *y* (MWh)
$EL_{PJ,aux,y}$	=	Total auxiliary electricity consumption required for the operation of the power plants in year *y* (MWh)

$EL_{PJ,aux,y}$ includes all electricity required for the operation of equipment related to the preparation, storage and transport of biomass residues (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.) and electricity required for the operation of all power or heat generating plants which are located at the project site and included in the project boundary (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.).

Step 2.2: Determine the baseline electricity sourced from the grid *($EG_{BL,GR,y}$)*

The amount of electricity that would be sourced from the grid in the baseline is calculate assuming that the amount of electricity generated on-site and off-site in the baseline shall be limited by the installed capacity of power generation available in the baseline scenario (on-site and off-site):

$$EL_{BL,GR,y} = max(0, EL_{BL,y} - CAP_{EG,total,y}) \quad \text{Equation (4)}$$

Where:

$EL_{BL,GR,y}$	=	Baseline electricity sourced from the grid in year *y* (MWh)
$EL_{BL,y}$	=	Baseline electricity generation in year *y* (MWh)
$CAP_{EG,total,y}$	=	Baseline electricity generation capacity in on-site and off-site plants in year *y* (MWh)

Step 2.3: Determine the emission factor of grid electricity generation *($EF_{EG,GR,y}$)*

The grid emission factor ($EF_{EG,GR,y}$) shall be determined using the latest approved version of "TOOL07: Tool to calculate the emission factor for an electricity system".

Step 2.4: Determine the emission factor of on-site electricity generation with fossil fuels ($EF_{EG,FF,y}$)

Since no fossil fuel based power generation was identified as part of the baseline scenario, $EF_{EG,FF,y} = EF_{EG,GR,y}$.

Step 3: Determine the baseline biomass-based heat and power generation

Step 3.1: Determine the baseline biomass-based heat generation ($HG_{BL,BR,y}$)

$$HG_{BL,BR,y} = \sum_h \sum_n (BR_{B5,n,h,y} \times NCV_{BR,n,y} \times \eta_{BL,HG,BR,h}) \quad \text{Equation (5)}$$

Where:

$HG_{BL,BR,y}$	=	Baseline biomass-based heat generation in year *y* (GJ)
$BR_{B5,n,h,y}$	=	Quantity of biomass residues of category *n* used in heat generator *h* in year *y* with baseline scenario B5 (tonne on dry-basis)
$NCV_{BR,n,y}$	=	Net calorific value of biomass residue of category *n* in year *y* (GJ/tonne on dry-basis)
$\eta_{BL,HG,BR,h}$	=	Baseline biomass-based heat generation efficiency of heat generator *h* (ratio)

Step 3.2: Determine the baseline biomass-based cogeneration of process heat and electricity and heat extraction

Based on the quantity of heat used in the heat engine the biomass-based cogeneration electricity and heat have been estimated as follows:

$$EL_{BL,BR,CG,y} = \frac{1}{3.6} \times \sum_{i} \left(\frac{1}{(HPR_{BL,i} + 1)} \times \eta_{BL,EG,CG,i} \times HG_{BL,BR,CG,y,i} \right)$$ Equation (6)

$$HC_{BL,BR,CG,y} = \sum_{i} \left(\frac{HPR_{BL,i}}{(HPR_{BL,i} + 1)} \times \eta_{BL,EG,CG,i} \times HG_{BL,BR,CG,y,i} \right)$$ Equation (7)

Where:

$EL_{BL,BR,CG,y}$	=	Baseline biomass-based cogenerated electricity in year *y* (MWh)
$\eta_{BL,EG,CG,i}$	=	Baseline electricity generation efficiency of heat engine *i*(MWh/GJ)
$HG_{BL,BR,CG,y,i}$	=	Baseline biomass-based heat used in heat engine *i*in year *y* (GJ)
$HC_{BL,BR,CG,y}$	=	Baseline biomass-based process heat cogenerated in year *y* (GJ)
$HPR_{BL,i}$	=	Baseline heat-to-power ratio of the heat engine *i*(ratio)

Case 3.2.3: $HG_{BL,BR,y} > \sum_i HG_{BL,BR,CG,y,i}$ and $HC_{BL,y} \geq HC_{BL,BR,CG,y}$ is verified

i.e. there would be biomass-based heat in the baseline that could still be used and process heat demand to be met. It is assumed then that this balance of biomass-based heat would be extracted from the heat header and used to meet the process heat demand without cogeneration of power.

As per case 3.2.3.2. the balance of biomass-based heat (right-hand side of the equation 14) is less than the remaining demand for process heat (left-hand side of the equation). Then all biomass-based heat is used and there still remains process heat demand to be met. However this lack of biomass- based heat is supplied through the two remain boilers, which feed directly the sugar mill process without cogeneration.

Moreover, no fossil fuels use occurs in the current business-as-usual baseline

$$HC_{BL,y} - HC_{BL,BR,CG,y} > \frac{h_{LOW,y}}{h_{HIGH,y}} \times \left(HG_{BL,BR,y} - \sum_{i} HG_{BL,BR,CG,y,i} \right),$$

Therefore, the slight resulting difference $HC_{balance,FF,y}$ is considered as due to inappropriate default values and conservatively neglected, as well as $EL_{balance,FF,y}$, and step 4 are skipped.

Step 4: Determine the baseline demand for fossil fuels to meet the balance of process heat and the corresponding electricity generation

As mentioned before, the use of fossil fuels has not been considered therefore the step 4 does not apply.

Step 5: Determine the baseline emissions due to uncontrolled burning or decay of biomass residues

Project participants decided not to include these emission sources. Therefore, $BE_{BR,y}$= 0.

In pre project scenario PP was operating low pressure boiler and back pressure turbine. In pre project scenario power and steam generated, utilize for inhouse consumption only and additional power procure from grid. Therefore, in project scenario PP is claiming emission reduction on power supplied to national grid and considering only parameters relevant for power supplied to national grid.

Baseline emissions

$$BE_y = EL_{BL,GR,y} \times EF_{EG,GR,y} + \sum_f FF_{BL,HG,y,f} \times EF_{FF,y,f} + EL_{BL,FF/GR,y} \times min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y}$$

$$EL_{BL,y} = 1{,}377{,}272\ MWh$$

$BEy = EL_{BL,y}$ X $EF_{gridCM,y}$ = 1,377,272 X 0.137 = 188,681 tCO2e

4.2 ProjectEmissions

Project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG2,y} + PE_{BC,y}$$ Equation (8)

Determination of PE_{FFy}

The following emission sources should be included in determining $PE_{FF,y}$:

- Emissions from on-site fossil fuel consumption for the generation of electric power and heat. This includes all fossil fuels used at the project site in heat generators (e.g. boilers) for the generation of electric power and heat; and
- Emissions from on-site fossil fuel consumption of auxiliary equipment and systems related to the generation of electric power and heat. This includes fossil fuels required for the operation of auxiliary equipment related to the power and heat plants (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.) which are not accounted in the first bullet, and fossil fuels required for the operation of equipment related to the preparation, storage and transportation of fuels (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.).

➔ At the time of PDD elaboration DG set used in project boundary as a back up. Amount of diesel consumption considered as part of project emission. Tool 3: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" used to calculate $PE_{FF,y}$.

$PE_{FF,y} = Q_{diesel} \times EF_{diesel} \times \rho_{diesel} \times NCV_{diesel}$

$PE_{FF,y} = 25001 \times 43 \times 0.83 \times 74.1 \times 10^{-6} =$ **71 tCO_2e**

Determination of $PE_{GR1,y}$

If electricity is imported from the grid to the project site during year *y*, corresponding emissions should be accounted for as project emissions, as follows:

$$PE_{GR1,y} = EF_{EG,GR,y} \times EL_{PJ,imp,y} \quad \text{Equation (9)}$$

Where:

$PE_{GR1,y}$	=	Emissions during the year *y* due to grid electricity imports to the project site (t CO_2)
$EL_{PJ,imp,y}$	=	Project electricity imports from the grid in year *y* (MWh)
$EF_{EG,GR,y}$	=	Grid emission factor in year *y* (t CO_2/MWh)

No electricity imports are envisaged from the grid, except in the unlikely situation of default of the turbo-generator. If this situation occurs electricity from the grid will be monitored and therefore the related project emissions will be accounted. For the purpose of the ex-ante estimations in the PDD $PE_{GR1,y} = 0$.

Determination of $PE_{GR2,y}$

If $EL_{balance,PO,y} < EL_{BL,BR,PO,y}$ (Step3.3.2) or $EL_{balance,FF,y} < EL_{BL,FF,y}$ (Step4.2.2), the amount of electricity generated on-site in the baseline is higher than the amount of electricity generated in the project scenario. In such cases, it is assumed that an equivalent amount of electricity is generated during year *y* in order to offset this reduction in electricity generation at the project site. Corresponding emissions should be accounted as project emissions as follows:

$$PE_{GR2,y} = EF_{EG,GR,y} \times EL_{PJ,offset,y} \quad \text{Equation (10)}$$

Where:

$PE_{GR2,y}$	=	Emissions due to a reduction in electricity generation at the project site in year *y* (tCO_2)
$EF_{EG,GR,y}$	=	Grid emission factor in year *y* (tCO_2/MWh)
$EL_{PJ,offset,y}$	=	Electricity that would be generated in the baseline that exceeds the generation of electricity during year *y* (MWh)

The amount of electricity generated on-site in the baseline does not exceed the amount of electricity generated in the project scenario, therefore $PE_{GR2,y} = 0$.

Determination of $PE_{TR,y}$

In cases where the biomass residues are not generated directly at the project site, project participants shall determine CO_2 emissions resulting from transportation of the biomass residues to the project plant.

➔ Since no additional biomass residues used in the project activity are transported from the fields compared to the baseline practise, no related project emissions are accounted for and $PE_{TR,y} = 0$.

Determination of $PE_{BR,y}$

If project proponents chose to include emissions due to uncontrolled burning or decay of biomass residues ($BE_{BR,y}$) in the calculation of baseline emissions, then emissions from the combustion of biomass residues have also to be included in the project scenario. Otherwise, this emission source may be excluded.

➔ Emissions due to uncontrolled burning or decay of biomass residues ($BE_{BR,y}$) were not included in the calculation of baseline emissions, therefore $PE_{BR,y}= 0$.

Determination of $PE_{WW,y}$

This emission source should be estimated in cases where wastewater originating from the treatment of the biomass is (partly) treated under anaerobic conditions and where methane from the waste water is not captured and flared or combusted.

➔ There is no anaerobic wastewater treatment due to project activity therefore $PE_{WW,y}= 0$.

Determination of $PE_{BG2,y}$

This emission source is considered in case of biogas production.
➔ As there is no production of biogas due to project activity therefore $PE_{BG2,y}= 0$.

Determination of $PE_{BC,y}$

According to the methodology, if the project includes biomass from dedicated plantations, the associated project emissions shall be calculated according to the methodological tool “Project and leakage emissions from biomass”.

For now, according to the baseline scenario defined in above section there is not cultivation of land to produce biomass therefore can be considered as $PE_{BC,y}= 0$.

Determination of $PE_{BRP,y}$

According to tool 16 Project and leakage emissions from biomass, para 9, tool 16 is applicable if biomass residues are consumed in a CDM project activity, and the biomass residues can be utilized after processing or without processing. (b) The result of an agro industrial process under the control of the project proponents. As PP is procuring biomass residues from it’s own sugar plant tool 16 will be applicable.

As per section 5.3 of tool 16, project emissions resulting from processing of biomass residues in year y ($PE_{BRP,y}$)

$$PE_{BRP,y} = PE_{BRP,electricity,y} + PE_{BRP,fuel,y} + PE_{BRP,CH4,y} + PE_{BRP,COMP,y} + PE_{BRP,AD,y} + PE_{BRP,ww,y} + PE_{BP,additives,y} \quad \text{Equation (10)}$$

$PE_{BRP,electricity,y}$ = Project emissions resulting from the consumption of electricity due to thermo-chemical, biological and mechanical processing of the biomass residues in year y (tCO_2e) (Power generated from co-generation boiler is getting used in plant there is no grid power or fossil fuel based power getting used in processing plant therefore $PE_{BRP,electricity,y}= 0$)

$P_{EBRP,fuel,y}$ = Project emissions resulting from the consumption of fossil fuels due to thermo-chemical, biological and mechanical processing of the biomass residues in year y (tCO_2e) (There is no fossil fuel getting consumed in biomass residue processing therefore $P_{EBRP,fuel,y}= 0$)

$PE_{BRP,CH4,y}$ = Project methane missions resulting from the decay of biomass residues under anaerobic conditions due to thermo-chemical, biological and mechanical processing in year y (tCO_2e) (There is no methane emissions is biomass residue processing therefore $PE_{BRP,CH4,y}= 0$)

$PE_{BRP,COMP,y}$ = Project emissions associated resulting from composting due to thermochemical, biological and mechanical processing of the biomass residues in year y (tCO_2e)(There is no composting is happening in biomass residue processing therefore $PE_{BRP,COMP,y}= 0$)

$PE_{BRP,AD,y}$ = Project emissions resulting from the anaerobic digester due to thermochemical, biological and mechanical processing of the biomass residues in year y (tCO_2e) (There is no anaerobic digester in place in biomass residue processing therefore $PE_{BRP,AD,y}= 0$)

$PE_{BRP,ww,y}$ = Project emissions resulting from wastewater treatment due to thermochemical, biological and mechanical processing of the biomass residues in year y (tCO_2e) (There is no waste water treatment is happening in biomass residue processing therefore $PE_{BRP,ww,y}= 0$)

$PE_{BRP,additives,y}$ = Project emissions resulting from the use of additives to process the biomass residues in year y (tCO_2e) (There is no additives getting use in biomass residues processing therefore $PE_{BRP,additives,y}= 0$)

Therefore, $PE_{BRP,y}$= 0

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG2,y} + PE_{BC,y}$$

PEy = 71+0+0+0+0+0+0+0 = 71 tCO_2e

4.3 Leakage

Leakage emissions due to diversion of biomass residues from other applications shall be calculated according to the methodological tool “Project and leakage emissions from biomass”.

➔ Leakage emissions due to shift of pre-project activities shall be calculated according to the methodological tool "Project and leakage emissions from biomass". No biomass scenarios for biomass residues used in the Project activity are subject to leakage, therefore **LEy = 0**.

4.4 Estimated Net GHG Emission Reductions and Removals

Emission reduction:

ERy = BEy – PEy – LEy
Where:

ERy = Emission reductions in year y (t CO_2e)
BEy = Baseline emissions in year y (t CO_2e)
PEy = Project emissions in year y (t CO_2e)

LEy = Leakage emissions in year y (tCO_2e)

The detailed calculation has been provided in the Excel Sheet.

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
19/07/2021 - 31/12/2021	8,528	4	0	8,524
01/01/2022 - 31/12/2022	18,985	7	0	18,978
01/01/2023 - 31/12/2023	18,985	7	0	18,978
01/01/2024 - 31/12/2024	18,985	7	0	18,978
01/01/2025 - 31/12/2025	18,985	7	0	18,978
01/01/2026 -	18,985	7	0	18,978

31/12/2026				
01/01/2027 - 31/12/2027	18,985	7	0	18,978
01/01/2028 – 31/12/2028	18,985	7	0	18,978
01/01/2029 – 31/12/2029	18,985	7	0	18,978
01/01/2030 – 31/12/2030	18,985	7	0	18,978
01/01/2031 – 18/07/2031	9,288	4	0	9,284
Total	**188,681**	**71**	**0**	**188,610**

5 MONITORING

In pre project scenario PP was operating low pressure boiler and back pressure turbine. In pre project scenario power and steam generated, utilize for inhouse consumption only and additional power procure from grid. Therefore, in project scenario PP is claiming emission reduction on power supplied to national grid and considering only parameters relevant for power supplied to national grid.

5.1 Data and Parameters Available at Validation

Data / Parameter	EF_{Diesel}
Data unit	*tCO_2e/TJ*
Description	Emission factor of diesel

Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventorieshttps://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf
Value applied	74.1
Justification of choice of data or description of measurement methods and procedures applied	2006 IPCC default value
Purpose of Data	Project emission calculation
Comments	

Data / Parameter	ρ_{diesel}
Data unit	Kg/Litre
Description	Density of diesel fuel
Source of data	CO_2 Baseline Database for the Indian Power Sector by the Central Electricity Authority, Ministry of Power, Government of India: http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver6.pdf(Page 26)
Value applied	0.83
Justification of choice of data or description of measurement methods and procedures applied	The value is provided by CEA, a government of India source
Purpose of Data	Calculation of project emissions
Comments	

Data / Parameter	$NCV_{i,y}$
Data unit	*TJ/Gg*

Description	Net calorific value of the diesel fuel in year ‘y’
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value applied	43
Justification of choice of data or description of measurement methods and procedures applied	The value is provided by IPCC
Purpose of Data	Calculation of project emissions
Comments	

5.2 Data and Parameters Monitored

Data / Parameter	$EL_{PJ,gross,y}$
Data unit	MWh
Description	Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y* (MWh)
Source of data	On site measurement
Value of data applied for the purpose of calculating expected emission reductions	202,800
Description of measurement methods and procedures to be applied	Use calibrated electricity meters of accuracy class 0.2s or better. SCOUL will be responsible for calibration of this meter once every 3 years. Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures to be applied	The consistency of metered electricity generation should be cross-checked with receipts from electricity sales (if available). PP is also tracking generation data in log book on daily basis which can be cross checked. Therefore, if there will be any inconsistency in data recording it can be track easily and rectify.
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$EL_{PJ,imp,y}$
Data unit	MWh
Description	Project electricity imports from the grid in year y (MWh)
Source of data	On site measurement
Value of data applied for the purpose of calculating expected emission reductions	0
Description of measurement methods and procedures to be applied	Use calibrated electricity meters of accuracy class 0.2s or better. UETCL will be responsible for calibration of this meter once every 3 years. Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures to be applied	The consistency of metered electricity generation should be cross-checked with receipts from electricity purchases.
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$EL_{PJ,aux,y}$
Data unit	MWh
Description	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh).
Source of data	On site measurement
Value of data applied for the purpose of calculating expected emission reductions	64,220
Description of measurement methods and procedures to be applied	Use calibrated electricity meters of accuracy class 0.2s or better. SCOUL will be responsible for calibration of this meter once every 3 years. Data monitored continuously and aggregated as appropriate, to calculate emissions reductions.
QA/QC procedures to be applied	The consistency of metered electricity generation should be cross-checked with receipts from electricity sales. PP is also tracking auxiliary consumption data in log book on daily basis which can be cross checked.Therefore, if there will be any inconsistency in data recording it can be track easily and rectify.

Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	Q_{Diesel}
Data unit	Litre
Description	Quantity of diesel consumption
Source of data	On site measurement
Value of data applied for the purpose of calculating expected emission reductions	2,500
Description of measurement methods and procedures to be applied	*Data monitored on monthly basis and recorded in plant* log book. PP did a monitoring of diesel tank in DG set and based on consumption value it recorded in log book.
QA/QC procedures to be applied	NA
Comments	Data will be kept for crediting period + 2 years.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2e/MWh
Description	Combined Margin Emission Factor of the national grid
Source of data	CDM standardized baseline https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20220811154530340/ASB0054-2022_PSB0058.pdf
Value of data applied for the purpose of calculating expected emission reductions	0.1370
Description of measurement methods and procedures to be applied	CDM standardized baseline valid from 10th Aug 2022 to 9th August 2025.
QA/QC procedures to be applied	NA
Comments	NA

5.3 Monitoring Plan

For above stated parameters for which monitoring and measurements apply, Supervisors take measurements and records are made.

Management of SCOUL ensures that appropriate equipment's required for the measurement are provided.

These measuring instruments viz., Weigh Bridgeand energy meters are calibrated from third party instrumentation labs once in three years, and records of it are maintained.

All the monitoring equipments required for the calculation of emission reductions have been installed after procedural check; therefore there is less possibility of defects. However, all these equipments are daily inspected by the concerned operator while taking the reading. In case of any irregular reading or unexpected reading the shift in charge is informed for further check and calibration of the equipments. More over all the equipment are calibrated once in a three year to ensure proper data value.

Internal audit will be carried out by the upper management once in three months. In case of having corrective action or preventive action it will be checked in next internal audit.

Responsibility and competence of persons taking measurement, when the measurement should take place and controls of records are established.

Data, which are collected, are safely stored. Records such as log books, purchase receipts, calibration records of measuring devices, and public data such as IPCC are maintained for the retention period specified.

Data of inputs and outputs are summarized on monthly basis and calculation of emission reduction is updated.

Emergency preparedness:

The operational staff's main task is to keep a close watch on a day to day basis on the functioning of the major equipment in the power plant. The operating staff would also document the downtime and operating hours for the major plant equipment along with the reasons for the downtime. The operating staff would summarize the logbook data on a monthly basis and report the same to the Senior Manager.

Additionally, it will ensure supply of sufficient quantity of critical and essential spares and consumables for the requirement of the machines. These critical and essential spares and consumables shall be stocked at the project site to reduce the machine repair downtime. A complete set of tools and tackles will be maintained at the site at the project site. The site in-charge together with the staff would ensure that periodic maintenance checks are performed on all major components. SCOUL would also maintain spare meters at the site. In case, if any of the meters are found to be providing faulty readings, they will be replaced with the spare meters. The spare meters will also be calibrated once every 3 years basis. If there is any fault recorded in grid energy meters, it's reported to UETCL and UETCL staff take appropriate action on that. If any fault recorded in grid energy main meter, UETCL and SCOUL considered check meter reading.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	$EL_{PJ,gross,y}$
Data unit	MWh
Description	Gross quantity of electricity generated in all power plants which are located at the project site and included in the project boundary in year *y* (MWh)
Value applied:	77,917.17 (77906.77 MWh from generator and 10.40 MWh from DG set)
Comments	*NA*

Data / Parameter	$EL_{PJ,imp,y}$
Data unit	MWh
Description	Project electricity imports from the grid in year y (MWh)
Value applied:	994.95 MWh
Comments	*NA*

Data / Parameter	$EL_{PJ,aux,y}$
Data unit	MWh
Description	Total auxiliary electricity consumption required for the operation of the power plants at the project site in year y (MWh).
Value applied:	26,123.88
Comments	*NA*

Data / Parameter	Q_{Diesel}
Data unit	Litre
Description	Quantity of Diesel consumption
Value applied:	2,780
Comments	*NA*

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2e/MWh
Description	Combined Margin Emission Factor of the national grid
Value applied:	0.1370
Comments	CDM standardized baseline valid from 10th Aug 2022 to 9th August 2025.

6.2 Baseline Emissions

Baseline emissions are calculated as follows:

$$BE_y = EL_{BL,GR,y} \times EF_{EG,GR,y} + \sum_f FF_{BL,HG,y,f} \times EF_{FF,y,f} + EL_{BL,FF/GR,y} \times min(EF_{EG,GR,y}, EF_{EG,FF,y}) + BE_{BR,y} \quad \text{Equation (11)}$$

Where:

BE_y = Baseline emissions in year *y* (t CO_2)

$EL_{BL,GR,y}$ = Baseline electricity sourced from the grid in year *y* (MWh)

$EF_{EG,GR,y}$ = Grid emission factor in year *y* (t CO_2/MWh)

$FF_{BL,HG,y,f}$ = Baseline fossil fuel demand for process heat in year *y* (GJ)

$EF_{FF,y,f}$ = CO_2 emission factor for fossil fuel type *f* in year *y* (t CO_2/GJ)

$EL_{BL,FF/GR,y}$ = Baseline uncertain electricity generation in the grid or on-site or off-site power-only units in year *y* (MWh)

$EF_{EG,FF,y}$	=	CO_2 emission factor for electricity generation at the project site or off-site plants in the baseline in year *y* (t CO_2/MWh)
$BE_{BR,y}$	=	Baseline emissions due to disposal of biomass residues in year *y* (t CO2e)
f	=	Fossil fuel type

The amount of electricity that would be generated in the baseline in year *y* equals the amount of electricity generated in the project scenario as follows:

$$EL_{BL,y} = EL_{PJ,gross,y} + EL_{PJ,imp,y} - EL_{PJ,aux,y} \quad \text{Equation (12)}$$

Where:

$EL_{BL,y}$	=	Baseline electricity generation in year *y* (MWh)
$EL_{PJ,gross,y}$	=	Gross quantity of electricity generated in all power plants included in the project boundary in year *y* (MWh)
$EL_{PJ,imp,y}$	=	Project electricity imports from the grid in year *y* (MWh)
$EL_{PJ,aux,y}$	=	Total auxiliary electricity consumption required for the operation of the power plants in year *y* (MWh)

$$EL_{BL,y} = 77917.17 - 26123.88 + 994.95 \quad \text{Equation (13)}$$

$EL_{BL,y}$ = 52,788.24 MWh

BE_y= $EL_{BL,y}$ X $EF_{gridCM,y}$ = 52,788.24 X 0.137 = 7,231 tC02e

In pre project scenario PP was operating low pressure boiler and back pressure turbine. In pre project scenario power and steam generated, utilize for inhouse consumption only and additional power procure from grid. Therefore, in project scenario PP is claiming emission reduction on power supplied to national grid and considering only parameters relevant for power supplied to national grid.

6.3 Project Emissions

Project emissions are calculated as follows:

$$PE_y = PE_{FF,y} + PE_{GR1,y} + PE_{GR2,y} + PE_{TR,y} + PE_{BR,y} + PE_{WW,y} + PE_{BG2,y} + PE_{BC,y} \quad \text{Equation (14)}$$

Determination of PE_{FFy}

The following emission sources should be included in determining $PE_{FF,y}$:

- Emissions from on-site fossil fuel consumption for the generation of electric power and heat. This includes all fossil fuels used at the project site in heat generators (e.g. boilers) for the generation of electric power and heat; and
- Emissions from on-site fossil fuel consumption of auxiliary equipment and systems related to the generation of electric power and heat. This includes fossil fuels required for the operation of auxiliary equipment related to the power and heat plants (e.g. for pumps, fans, cooling towers, instrumentation and control, etc.) which are not accounted in the first bullet, and fossil fuels required for the operation of equipment related to the preparation, storage and transportation of fuels (e.g. for mechanical treatment of the biomass, conveyor belts, driers, etc.).

➔ At the time of PDD elaboration DG set used in project boundary as a back up. Amount of diesel consumption considered as part of project emission. Tool 3: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" used to calculate $PE_{FF,y}$.

Quantity of diesel consumption = 2780 lt

$PE_{FF,y}$ = Qdiesel X EFdiesel X ρdiesel X NCVdiesel

$PE_{FF,y}$ = 10 tCO_2e

6.4 Leakage

Leakage emissions due to diversion of biomass residues from other applications shall be calculated according to the methodological tool "Project and leakage emissions from biomass".

➔ Leakage emissions due to shift of pre-project activities shall be calculated according to the methodological tool "Project and leakage emissions from biomass". No biomass scenarios for biomass residues used in the Project activity are subject to leakage, therefore LE_y = 0.

6.5 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
19/07/2021 – 31/12/2021	7,231	10	0	7,221
Total	7,231	10	0	7,221

As per PDD annual emission reduction (tCO2e)	18861

Number of days in monitoring period	166
Ex-ante emission reduction as per PDD (tCO2e)	8578
Actual Achieved emission reduction (tCO2e)	7221
Difference	1357
% Difference	-18.79%

APPENDIXI: METER CALIBRATION DETAILS

Meter location	Make	Sr. Number	Calibration Date	Calibration Due date
Power Generation	GE Multllin	E7392532	16/12/2019	15/12/2022
Power export to grid	GE Multillin	E7300990	03/06/2020	02/06/2023
Distribution Transformer No. 1	Secure	X1359870	06/06/2020	05/06/2023
Distribution Transformer No. 2	Secure	X1359863	06/06/2020	05/06/2023
Converter Transformer	Secure	X1359868	06/06/2020	05/06/2023
Sugar Plant Consumption	Secure	X1359866	06/06/2020	05/06/2023

UETCL Billing Meter

Meter	Sr. Number	Accuracy Class	Calibration date	Calibration Due date
Main Meter	WP027603	0.2s	18/06/2020	17/06/2023
Check Meter	WP027604	0.2s	19/06/2020	18/06/2023

APPENDIX 2: SDG CO-BENEFITS DETAILS

Skill Development Training Details

Sugar Corporation of Uganda Limited
An ISO 9001 & 14001 Certified Company
P.O. BOX 1, LUGAZI, UGANDA. Tel: 256-312-55 55 00, Fax: 256-312-55 52 96
Email: scoul@mehtagroup.com Website: www.mehtagroup.com

Date: 18/08/2022

TO WHOMSOEVER IT MAY CONCERN

We, Sugar Corporation of Uganda Limited (SCOUL), declare that we have provided skill development training to 120 persons under the "Biomass Cogeneration Plant by SCOUL" project. As a part of the skill development program, we provided Operation and Maintenance of Cogeneration plant training and as well as Cogen Equipment Technical Support detailed training to the trainees. The training also imparted the knowledge of adversities of climate change and importance of mitigation actions to the trainees. The trainings were conducted in SCOUL Complex, Lugazi, Buikwe District of Uganda. The details of the training are provided below.

Training No. 1

Name of the Training	Boiler Operation and Maintenance
Date	10th July 2021 to 31st August 2021
Location	SCOUL, Cogen Plant
Name of the Trainer	ISGEC - Mr.Pankaj Kapoor, Mr.Dhakshinamurthi SCOUL – Mr.Sivakumar, Mr.Anantha Kumar, Mr.Jeganath Salunke
Topics Covered	a) Bagasse Feeding System b) Feedwater system c) Boiler Steam Generation (DCS & Field) d) Ash handling system
No. of Male Participants	82
No. of Female Participants	0

Training No. 2

Name of the Training	Turbine and Cooling Tower Operation
Date	15th July to 10th Aug 2021
Location	SCOUL, Cogen Plant
Name of the Trainer	STDE – Mr.Anandharao, ISGEC – Mr.Asoka, Mr.Pookannan, SCOUL – Mr.S.Murali
Topics Covered	a) Turbine Start up procedures b) Enabling & Disabling Steam extraction from Turbine through Governor & DCS c) Cooling tower operation
No. of Male Participants	9
No. of Female Participants	0

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Kampala office: 133/135, 6th Street Industrial Area, P.O. Box 1185, Kampala UGANDA. Tel: 256-414-25 50 38 Fax: 256-414-34 75 97

Training No. 3

Name of the Training	Water Treatment plant operation
Date	15th June – 31st July 2021
Location	SCOUL, Cogen Plant - WTP
Name of the Trainer	SCOUL - Mr. Sivakumar, Mr.Sudhakar,
Topics Covered	a) Raw water management b) DM Plant operation c) RO Plant operation d) Analysis of Raw water, Boiler water, Cooling tower water e) Monitoring and maintain of Water parameters
No. of Male Participants	8
No. of Female Participants	0

Training No. 4

Name of the Training	Electrical system in Cogen plant
Date	15th – 31st July 2021
Location	SCOUL, Cogen Power House
Name of the Trainer	STDE – Mr.Anil Kumar, Mr.Praveen Kumar, ISGEC – Mr.Asoka, SCOUL – Mr.Marichelvan,
Topics Covered	a) Electrical Power distribution system (SLD) b) Power Import from 33KV Grid and distribution c) 30MW Generator startup, synchronisation with Grid, and Evacuation line operation. d) DG operation and distribution on emergency e) Generator, Grid Protection and metering system f) Energy Monitoring system
No. of Male Participants	12
No. of Female Participants	1

Training No. 5

Name of the Training	Instrumentation system in Cogen plant
Date	1st – 31st July 2021
Location	SCOUL, Cogen DCS Control Room
Name of the Trainer	STDE – Mr.Anil Kumar, Mr.Praveen Kumar, ISGEC – Mr.Asoka, SCOUL – Mr.Manoj Kumar Verma,
Topics Covered	a) Field Instruments Operation and maintenance b) Testing and calibration of Field Instruments c) DCS – Logics and controls on Boiler and Turbine operation
No. of Male Participants	7
No. of Female Participants	1

We continue to support the trainees by providing them with regular qualitative inputs to improve their skills.

Thanking you & With Regards,

Yours Sincerely,

For: SUGAR CORPORATION OF UGANDA LIMITED

Vijay Dongare
DY. CHIEF EXECUTIVE PROJECTS

Employment Details

Sugar Corporation of Uganda Limited

An ISO 9001 & 14001 Certified Company

P.O. BOX 1, LUGAZI, UGANDA. Tel: 256-312-55 55 00, Fax: 256-312-55 52 96

Email: scoul@mehtagroup.com Website: www.mehtagroup.com

Date: 18/08/2022

TO WHOMSOEVER IT MAY CONCERN

We, Sugar Corporation of Uganda Limited (SCOUL), declare that we have provided employment to 155 persons under the "Biomass Cogeneration Plant by SCOUL" project by engaging them in the operation and maintenance of Co-generation plant. The trainees were engaged on monthly remuneration by the SCOUL and the details of the same is mentioned below.

Employment Details:

S/NO.	NAMES	AGE	GENDER	LOCATION	GROSS SALARY
1	Lubowa Joseph	53	Male	Automobile	330,000
2	Kijambu George	20	Male	Automobile	300,000
3	Katende Enock	26	Male	Automobile	300,000
4	Agasile . Peter	55	Male	Automobile	720,171
5	Ngaka Joseph	56	Male	Automobile	792,000
6	Abitia Michael	39	Male	Automobile	565,838
7	Kizza Charles	32	Male	Automobile	547,162
8	Baligeya Abbas	37	Male	Automobile	605,122
9	Nyanzi Alex Kizito	25	Male	Automobile	400,000
10	Aman P.Gad	28	Male	Automobile	413,784
11	Ogwang Benson	44	Male	Automobile	706,734
12	Edema Fredrick	24	Male	Automobile	325,000
13	Omara Samson	38	Male	Boiler-House	626,386
14	Addu Maurice	49	Male	Boiler-House	883,912

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Kampala office: 133/135, 6th Street Industrial Area, P.O. Box 1185, Kampala UGANDA. Tel: 256-414-25 50 36 Fax: 256-414-34 75 97

15	Malisi Emmanuel	38	Male	Boiler-House	666,468
16	Sengooba Muzafalu	37	Male	Boiler-House	629,599
17	Kavuma Newton	53	Male	Boiler-House	857,452
18	Okoth Samuel	48	Male	Boiler-House	727,542
19	Kaweesa Andrew	43	Male	Boiler-House	529,348
20	Kagoola Saul	26	Male	Boiler-House	237,608
21	Batalaze Ibrahim	46	Male	Boiler-House	499,693
22	Opoka Richard	38	Male	Boiler-House	560,817
23	Kunya Godfrey	38	Male	Boiler-House	611,415
24	Kyomuhendo Roger	29	Male	Boiler-House	301,196
25	Buyungo Lawrence	30	Male	Boiler-House	473,053
26	Ocen Tonny	36	Male	Boiler-House	463,134
27	Nabitu Abu	26	Male	Boiler-House	475,000
28	Kigozi Godfrey	38	Male	Boiler-House	422,145
29	Sekyanzi Willy	43	Male	Boiler-House	529,348
30	Katwere Charles	28	Male	Boiler-House	391,132
31	Ssempijja Andrew	35	Male	Boiler-House	298,396
32	Asea Ivan Junior	24	Male	Boiler-House	330,000
33	Etrima Wilbert	30	Male	Boiler-House	330,000
34	Magala Haruna	28	Male	Boiler-House	437,780
35	Afayo Emmanuel	48	Male	Boiler-House	392,448
36	Semuyaba Sadam	31	Male	Boiler-House	500,242
37	Bbosa Ali	26	Male	Boiler-House	360,000
38	Edema Rogers Wesley	22	Male	Boiler-House	325,000

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39	Debo Ivan Brian	25	Male	Boiler-House	350,000
40	Inziku Moses	36	Male	Boiler-House	490,070
41	Itaaka Brian	25	Male	Boiler-House	355,000
42	Kiwanuka Joseph	31	Male	Boiler-House	437,780
43	Muhirwe Gerald	28	Male	Boiler-House	355,000
44	Muyeri Paul	28	Male	Boiler-House	350,000
45	Kasita David	36	Male	Boiler-House	323,330
46	Ssenkaali Francis	31	Male	Boiler-House	335,000
47	Alemi Arafat	34	Male	Boiler-House	371,042
48	Amule Gideon	28	Male	Boiler-House	341,000
49	Okoth Moses	25	Male	Boiler-House	300,000
50	Ayikobwa Erick	24	Male	Boiler-House	300,000
51	Wanzinura Ivan	24	Male	Boiler-House	300,000
52	Kagombe Issa	26	Male	Boiler-House	300,000
53	Kaule Taddeo	30	Male	Boiler-House	300,000
54	Musinguzi Mufti	23	Male	Boiler-House	300,000
55	Alema Faruku	31	Male	Boiler-House	300,000
56	Ndugwa Mustafa	26	Male	Boiler-House	300,000
57	Kayanga Ismail	34	Male	Boiler-House	300,000
58	Jambo Patrick Angudipi	26	Male	Boiler-House	300,000
59	Edema Alfred	22	Male	Boiler-House	300,000
60	Ssemanda Rashid	22	Male	Boiler-House	300,000
61	Baku Alex	43	Male	Boiler-House	300,000
62	Ssenunjogi Umar	23	Male	Boiler-House	300,000

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63	Omeja Joseph	23	Male	Boiler-House	300,000
64	Semakanyi Steven	26	Male	Boiler-House	300,000
65	Mugabo Kelement Celly	24	Male	Boiler-House	300,000
66	Asiku Isaac Farouk	21	Male	Boiler-House	300,000
67	Wakobwa Shedrack	26	Male	Boiler-House	350,000
68	Mugadu Franco	34	Male	Boiler-House	350,000
69	Tabu Fred	28	Male	Boiler-House	350,000
70	Kizito Abdallah	24	Male	Boiler-House	350,000
71	Simiyu Fred	54	Male	Boiler-House	625,800
72	Bwambale Chrispus	39	Male	Boiler-House	375,000
73	Atreti Godfrey	26	Male	Boiler-House	300,000
74	Oneka Jimmy	24	Male	Boiler-House	315,000
75	Nsole John	27	Male	Boiler-House	375,000
76	Mubajje Noah	32	Male	Boiler-House	392,448
77	Mwirungu Nasser	59	Male	Boiler-House	1,000,000
78	Wanzira Fred	29	Male	Boiler-House	391,132
79	Malisi Gift	23	Male	Boiler-House	275,000
80	Obura Christopher	55	Male	Electrical	1,400,000
81	Ekapolon Elisha	46	Male	Electrical	1,471,280
82	Mbabali Lawrence	34	Male	Electrical	716,769
83	Nizeyimana Moses	30	Male	Electrical	749,000
84	Katuntu Sadat	30	Male	Electrical	642,000
85	Lati Dickens	35	Male	Electrical	760,304
86	Okia Aramathan	33	Male	Electrical	939,411

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87	Kibumba George	36	Male	Electrical	560,304
88	Wereh Martin	30	Male	Electrical	437,780
89	Osire Isaac	30	Male	Electrical	560,304
90	Kwiringira Edson	42	Male	Electrical	601,965
91	Onyango Derick	30	Male	Electrical	665,095
92	Kasigazi Moses	24	Male	Electrical	400,000
93	Kulumba Brian	30	Male	Electrical	400,000
94	Twikirize Johnson	33	Male	Electrical	786,793
95	Asindu Fred	29	Male	Electrical	464,576
96	Ojambo Bonface	36	Male	Electrical	450,000
97	Ojambo George	27	Male	Electrical	410,000
98	Komakech Geofrey	31	Male	WTP	392,448
99	Owollo Patrick	33	Male	WTP	463,134
100	Kizito Emmanuel	28	Male	WTP	323,330
101	Owor Emmanuel	26	Male	Time Office	422,000
102	Mwandha Anthony	34	Male	Time Office	380,200
103	Mulondo Haggai	25	Male	Time Office	375,000
104	Alyon Brian	27	Male	Time Office	375,000
105	Mudibo Samuel	38	Male	Offices	464,576
106	Kauka William	37	Male	Offices	600,000
107	Ochieng David Livingstone	28	Male	Offices	425,000
108	Mugabi Kalidi	25	Male	Offices	425,000
109	Nagulumbya Fred	39	Male	Offices	464,576
110	Achidi Jonathan	24	Male	Welfare	350,000

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111	Mugabi Hassan	42	Male	Turbine	720,171
112	Kirya Ronald	32	Male	Turbine	560,304
113	Gashongole Deo	26	Male	Turbine	400,000
114	Makande Muzafaru	27	Male	Turbine	473,053
115	Oyuki John	57	Male	Turbine	1,245,000
116	Atiku Herbert	36	Male	Turbine	600,000
117	Adungul Charles	52	Male	Turbine	811,107
118	Nyongesa Benjamin	33	Male	Turbine	472,675
119	Chandi Alfred	38	Male	Turbine	591,259
120	Eregu Samuel	29	Male	Turbine	473,053
121	Mwanja George	55	Male	Turbine	1,400,000
122	Muligo Wilson	27	Male	Instrumentation	692,982
123	Khisa Anthony	27	Male	Instrumentation	647,824
124	Talimusa Phillip	40	Male	Instrumentation	786,793
125	Lwama Alex	31	Male	Instrumentation	1,750,000
126	Kissa Victor	33	Male	Instrumentation	625,800
127	Amojira Jonan	31	Male	Instrumentation	1,100,000
128	Mulungi Paul	33	Male	Instrumentation	1,280,000
129	Namataka Esther	31	Female	Instrumentation	880,000
130	Mbulakyalo John Edwards		Male	Admnistration	2,500,000
131	Kitutu Doreen		Female	Admnistration	780,000
132	Mwota Isooba Joel		Male	Water Treatment Plant	1,100,000
133	Butita Simon Peter		Male	Water Treatment Plant	1,000,000
134	Wandah Eric Ivan		Male	Water Treatment Plant	850,000

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135	Kagoya Jesca		Female	Water Treatment Plant	500,000
136	Kabagambe Patrick		Male	Water Treatment Plant	600,000
137	Ndyamuba Obed		Male	Water Treatment Plant	680,000
138	Zziwa Sulaiman		Male	Water Treatment Plant	650,000
139	Pajoma David		Male	Electrical	1,723,290
140	Nganzi Ramadhan		Male	Electrical	800,000
141	Amuriat Simon		Male	Electrical	750,000
142	Kiiza Daniel		Male	Electrical	750,000
143	Mbaziira Davis		Male	Electrical	550,000
144	Ogwang Stephen		Male	Boiler	1,941,072
145	Ojok Samuel		Male	Boiler	2,096,050
146	Mawa Emmanuel		Male	Boiler	1,600,000
147	Ssemwanga Siraje		Male	Boiler	991,000
148	Mwanzi Marion		Male	Boiler	800,000
149	Adiga Raymond		Male	Boiler	800,000
150	Segujja Patrick		Male	Boiler	700,000
151	Masereka Asa		Male	Boiler	650,000
152	Nsimbe Laban		Male	Boiler	650,000
153	Thembo Geofrey		Male	Boiler	550,000
154	Aruho Steven		Male	Boiler	750,000
155	Atwijukye Pius		Male	Boiler	1,500,000

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We continue to support our employees by addressing any issues/queries raised by the employees while serving in the field and help them in finding solutions.

Thanking you & With Regards,

Yours Sincerely,

For: SUGAR CORPORATION OF UGANDA LIMITED

Vijay Dongare
DY. CHIEF EXECUTIVE PROJECTS

APPENDIX 3: IRR CALCULATION INPUT VALUES

Project Plant Data

		Project Plant		Source
Sugar Plant Parameters	Sugar Plant Capacity	4600	TCD	Plant data
	Bagasse to Cane Ratio	38%	%	Plant data
	Days of Operation	322	Days	Plant data
	Gross Captive Consumption inclusive of axilary consumption	9.50	MW	Plant data

Power Plant Parameters	Power Plant Capacity	30	MW	Commissioning certificate
	Plant Load Factor	95%	%	Assumed- Standard value
	No of Days of operation	330	Days	Assumed- Standard value
	Auxiliary Consumption	10.00%	%	Assumed- Standard value

Steam Parameters	Pressure	87	bar	Commissioning certificate
	Temperature	525	Deg C	Commissioning certificate
	Enthalpy	3464.00	kJ/kg	Steam table

Project Cost	Cost per MW	-	-	-
	Total Project Cost	43	million USD	Page 23to 28 FSR
	Debt	0.95	%	FSR
	Equity	0.05	%	FSR
	Interest on Long Term Debt	0.06	%	FSR

Operational Cost	O&M Cost	1611936	USD	FSR Page 26
	Escalation	5%		
	Manpower Cost- First	870	USD	FSR Page 118

	year of Operation	000		
	Escalation	5%	%	

Fuel Related Parameters	Cost for Inhouse Bagasse	0	USD	
	Cost of Procured Biomass	30	USD /Ton	Assumption based on market price of bagasse in our region
	Escalation	5%	%	
	Calorific Value of Bagasse	227 0	kcal /kg	SGS test report
		9.5 0	GJ/T on	Calculated
	Calorific Value of Biomass	300 0	kcal /kg	Assumed- Standard value
		12. 56	GJ/T on	Calculated

Tariff	First Ten Years of Operation	0.0 95	USD /kW h	PPA
	Escalation for 11th to 20th Year	10. 0%	%	Assumed conservatively

Tax	Minimum Alternate Tax	10. 00 %	%	Assumption
	Corporate Tax Rate	30. 00 %	%	As per IT Act (https://taxsummaries.pwc.com/uganda/cor porate/taxes-on-corporate-income)
	Tax Holiday Period	0	Year s	As per IT Act (https://taxsummaries.pwc.com/uganda/cor porate/taxes-on-corporate-income)

Depreciation as per Companies Act	Automation and computers	40 %	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/cor porate/deductions)
	Civil Works	5.0 0%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/cor porate/deductions)
	Mechanical & Electrical Equipments	20. 00 %	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/cor porate/deductions)

Depreciation as per IT Act	Land	0%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/cor porate/deductions)
	Civil Works	10. 00 %	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/cor porate/deductions)
	Mechanical & Electrical	5.0	%	As per Companies Act

	Equipments	0%		(https://taxsummaries.pwc.com/uganda/corporate/deductions)

Salvage Value	Plant, Machinery and Civil Works	10%	%	https://www.ugandainvest.go.ug/wp-content/uploads/2016/03/Inventory-of-Tax-Incentives-in-Uganda.pdf

Savings	HT Tariff (Energy Charges) (USD/kWh)	0.095	USD/kWh	PPA
	Demand Charges (USD/kWh)	3.17	USD/kWh	PPA

Reference Plant Data

		Reference Plant		Source
Sugar Plant Parameters	Sugar Plant Capacity	6000	TCD	Same as that in project case
	Bagasse to Cane Ratio	30%	%	Same as that in project case
	Days of Operation	322	Days	Same as that in project case
	Gross Captive Consumption inclusive of axilary consumption	9.50	MW	Same as that in project case

Power Plant Parameters	Power Plant Capacity	30.00	MW	Calculated
	Plant Load Factor	95%	%	Same as that in project case
	No of Days of operation	330	Days	Same as that in project case
	Auxiliary Consumption	10.00%	%	Same as that in project case

Steam Parameters	Pressure	45	bar	As per common practice
	Temperature	420	Deg C	
	Enthalpy	3253.4	kJ/kg	Steam table

Project Cost	Cost per MW			https://www.rvo.nl/sites/default/files/2019/02/Final-Energy-report-Uganda.pdf
	Total Project Cost	42.55	million USD	Calcuated as per that in project case
	Debt	0.70	%	Same as that in project case
	Equity	0.30	%	Same as that in project case

	Interest on Long Term Debt	0.06	%	Same as that in project case

Operational Cost	O&M Cost	1611936	USD	Same as that in project case
	Escalation	5%		Same as that in project case
	Manpower Cost- First year of Operation	870000	USD	Calcuated as per that in project case
	Escalation	5%	%	Same as that in project case

Fuel Related Parameters	Cost for Inhouse Bagasse	0	USD	Same as that in project case
	Cost of Procured Biomass	30	USD/Ton	Same as that in project case
	Escalation	5%	%	Same as that in project case
	Calorific Value of Bagasse	2270	kcal/kg	Same as that in project case
		9.50	GJ/Ton	Same as that in project case
	Calorific Value of Biomass	3000	kcal/kg	Same as that in project case
		12.56	GJ/Ton	Same as that in project case

Tariff	First Ten Years of Operation	0.095	USD/kWh	Same as that in project case
	Escalation for 11th to 20th Year	10%	%	Same as that in project case

Tax	Minimum Alternate Tax	10.00%	%	Assumption
	Corporate Tax Rate	30.00%	%	As per IT Act (https://taxsummaries.pwc.com/uganda/corporate/taxes-on-corporate-income)
	Tax Holiday Period	0	Years	As per IT Act (https://taxsummaries.pwc.com/uganda/corporate/taxes-on-corporate-income)

Depreciation as per Companies Act	Automation and computers	40%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/corporate/deductions)
	Civil Works	5.00%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/corporate/deductions)
	Mechanical & Electrical Equipments	20.00%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/corporate/deductions)

Depreciation as per IT Act	Land	0%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/corporate/deductions)
	Civil Works	10.00%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/corporate/deductions)
	Mechanical & Electrical Equipments	5.00%	%	As per Companies Act (https://taxsummaries.pwc.com/uganda/corporate/deductions)

Salvage Value	Plant, Machinery and Civil Works	10%	%	https://www.ugandainvest.go.ug/wp-content/uploads/2016/03/Inventory-of-Tax-Incentives-in-Uganda.pdf

Savings	HT Tariff (Energy Charges) (USD/kWh)	0.10	USD/kWh	https://www.umeme.co.ug/umeme_api/wp-content/uploads/2022/01/Tariffs-1.pdf
	Demand Charges (USD/kWh)	3.17	USD	https://www.umeme.co.ug/umeme_api/wp-content/uploads/2022/01/Tariffs-1.pdf