EAST AFRICAN
CRUDE OIL
PIPELINE

Green House Gases Management Summary

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The East Africa Crude Oil Pipeline (EACOP) Project is a 1443 kilometer (km) thermal insulated, buried export pipeline transporting oil from production fields in Uganda across Tanzania to a marine terminal and tanks (MTT) and a 2 km long Jetty on the Tanzanian coast for export by tanker to international markets. In addition to the pipeline and terminal, six pumping stations (PSs) and two pressure reduction stations (PRS) will help move the oil along the pipeline, as well as ensuring the safety of the facilities. Whilst EACOP takes custody of the oil when it is in transit through the system, the legal ownership and responsibility for oil sales beyond the EACOP Jetty remain with the upstream owners and producers of the oil.

This report sets out EACOP's approach to the management of greenhouse gas (GHG) emissions.

The internationally agreed practice to categorise GHG emissions is to divide them into Scope 1 and 2 emissions:

- **Scope 1** covers emissions from sources that EACOP owns or controls directly:
  - During construction – mainly from vehicles, transportation, construction equipment, and generators used during the construction process.
  - During operation - mainly from power generation used to back up power importation from grid.

- **Scope 2** covers emissions that EACOP causes indirectly from the energy purchased and used - mainly from generation of electricity purchased from the Ugandan and Tanzanian energy companies.

EACOP only has custody of the oil whilst it is in transit through the EACOP pipeline system, the legal ownership remains with the upstream owners up until the point of transfer of ownership at the Jetty loading arm flange.

Significant efforts have been made during the design phase to reduce Scope 1 and 2 GHG emissions through the application of best industry practices and Best Available Techniques (BAT), as well as by performing engineering studies.

Scope 1 and 2 emissions over the four-year construction phase are estimated at 384 thousand tonnes of carbon dioxide equivalent ($ktCO_2e$). Several GHG emissions reduction measures will be implemented.

For operations, an extensive analysis of alternatives has been undertaken over a number of years. In Uganda, the decision was taken at an early stage not to install EACOP's own power generation, but rather to take electrical power from the national grid together with any excess production from the upstream facilities. In Tanzania, there has been a reduction ranging from 40% to 50% in Scope 1 and 2 emissions by connecting the pumping stations and the marine terminal to the national grid which has much lower intensity. The conventional power generators would only be used as back-up. When GHG intensity is benchmarked against other long-distance oil pipelines, the EACOP values are the same as the average emissions intensity.

The EACOP Project is compatible with both Uganda and Tanzania's national climate change commitments, national development plans and energy policies, and will make a relatively minor contribution to the host countries' emissions (less than 1%). Project construction and operations will still allow the countries to meet their GHG targets.

EACOP provides quarterly GHG reports to the Ugandan and Tanzanian Governments and will publicly report on annual combined Scope 1 AND Scope 2 OPERATIONS GHG emissions and GHG efficiency ratio.

EACOP is in compliance with international financing requirements which centre around consideration of alternatives, annual reporting of GHG emissions, and publication of a summary and the GHG calculation methodology.

1. INTRODUCTION AND PURPOSE

1.1. Purpose of This Document

This document details the approach to management of greenhouse gas (GHG) emissions by the East Africa Crude Oil Pipeline (EACOP) Project by presenting:

- GHG-related requirements of EACOP standards.
- Project GHG emission sources.
- GHG emissions estimates and analysis of options to reduce the carbon footprint (CFR, Carbon Footprint Reduction).
- Compatibility with host country climate change commitments and policies.
- GHG reporting proposals.

Information from key studies undertaken by internationally recognised independent third parties are presented:

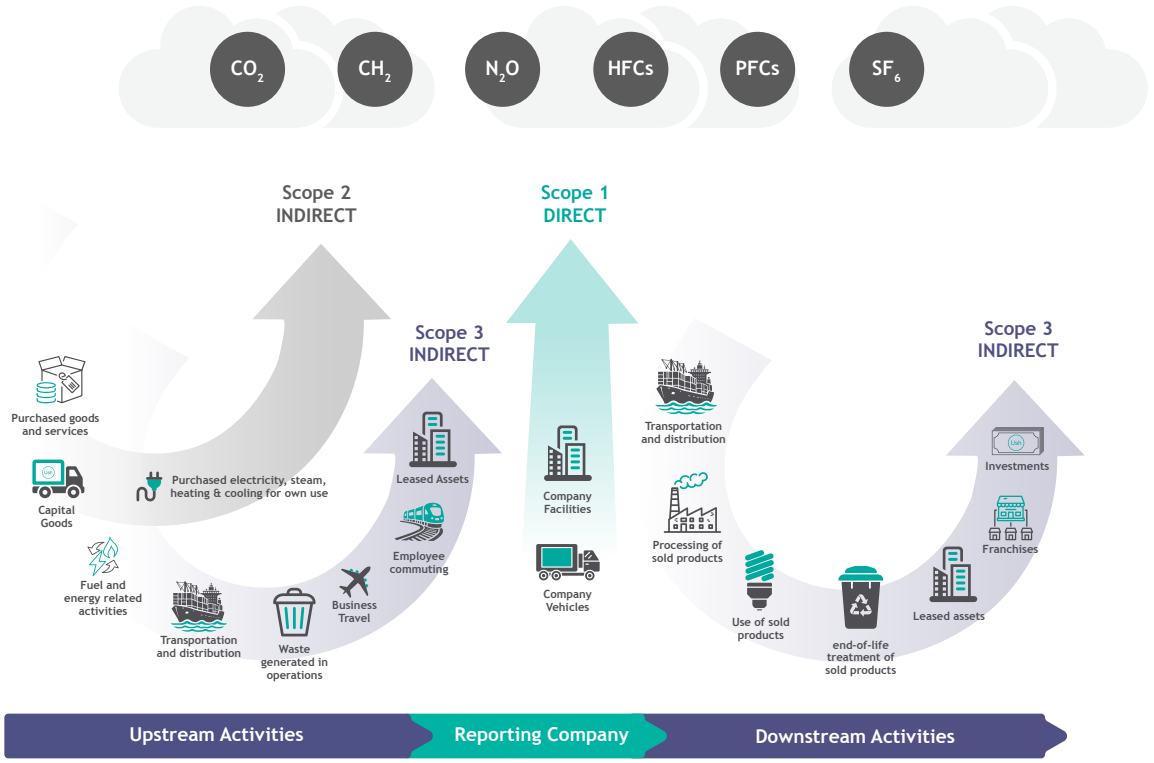
- Environmental and Social Impact Assessments (ESIAs) approved by the Government regulators in Uganda in November 2020 and in Tanzania in November 2019.
- A Best Available Technique (BAT) study for power generation for above ground facilities in Tanzania completed in 2020 and updated in 2022. In Uganda, previous analysis of alternatives in engineering studies and presented in the ESIA, had defined the power supply option that continues to be used in Project planning; that power is to be supplied from the existing electricity supply infrastructure.
- An estimation of EACOP lifetime emissions from pipeline construction and operations, and crude oil shipping, refining, and end use (2023).
- A construction emissions forecasting study (2023).
- An operations energy use and GHG forecast study (2023).
- Feasibility study for provision of power from solar (2021).
- Front end engineering (FEED) for CFR–(2022/2023).

1.2. GHG Emission Classification

EACOP considers the widely accepted classification for GHG emissions based on the source and level of control of a Project defined by the GHG Protocol. The GHG Protocol defines a reporting boundary for GHG emissions and segments the GHG sources within that boundary according to their scope, defined as:

- **Scope 1 emissions** - direct GHG emissions occurring from sources owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc. emissions from chemical production in owned or controlled process equipment.
- **Scope 2 emissions** - indirect GHG emissions from the generation of purchased electricity consumed by the company. These are associated with emission factors which relate the amounts of GHGs emitted by a business to a set amount of activity performed by that business.
- **Scope 3 emissions** - all other indirect GHG emissions that occur in a company's value chain. They are a consequence of the company's activities but occur from sources not owned or controlled by the company. Some examples of Scope 3 activities are extraction and production of purchased materials, transportation of purchased fuels, and use of sold products and services.

Figure 1.1: Typical Scope 1, 2, and 3 Emissions



(Source: Corporate Value Chain (Scope 3) Accounting and Reporting Standard – GHG Protocol)

Note that according to the GHG Protocol the upstream / downstream distinction is based on the financial transactions of the reporting company - upstream relates to purchased or acquired goods and services and downstream relates to sold goods and services.

1.3. The EACOP Project

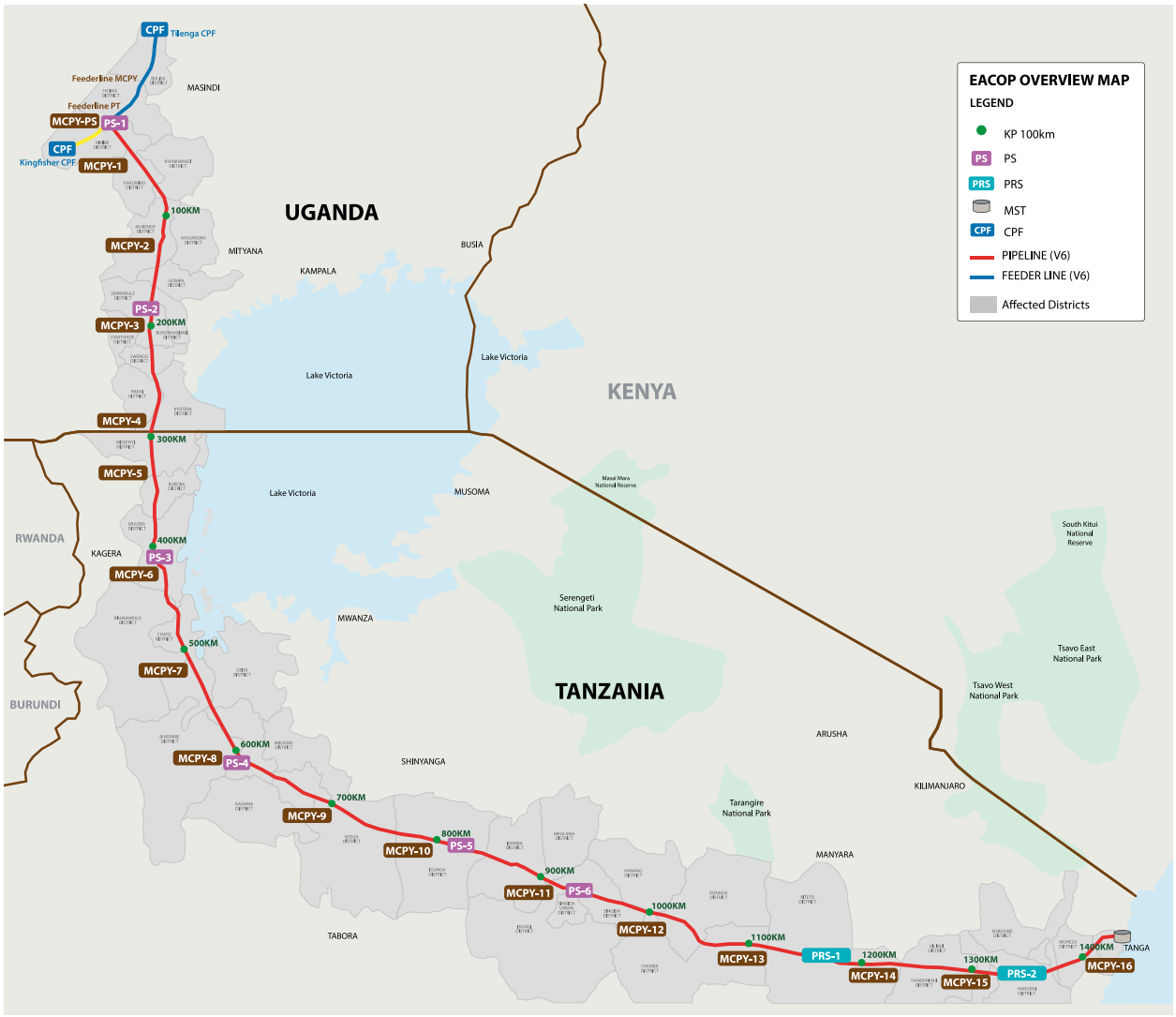
The Project is a 1443 km thermal insulated, buried export pipeline with six Pumping Stations (PSs) and two Pressure Reduction Stations (PRSs) that will transport oil from the Kabaale pumping station (PS1), in Hoima district, Uganda, to a marine terminal (MTT) and Jetty (load out facility (LOF) and trestle) at Chongoleani, Tanga district on the East African coast in Tanzania. The oil will be exported by tankers to international markets from the Jetty.

Electrical power is principally required for the various pumps to move the oil along the pipeline and onto tankers, to maintain and ensure proper viscosity at lower flow rates and in certain parts of the pipeline only after plateau production, i.e. about 5 to 6 years after start of production, as well as ancillary support systems along the pipeline and at the terminal. The viscous nature of the oil requires it to be maintained at a temperature above 50 degrees Celsius (°C) in the pipeline. This is primarily achieved by insulating the pipeline to retain the thermal energy coming from the upstream processing, complimented by electrical heat tracing along the pipeline and heaters at the MTT, for which power is required. Oil will be stored in the terminal storage up to 63°C and export to the tankers at its storage temperature.

EACOP provides a transit route for oil produced by the Tilenga and Kingfisher upstream projects in Uganda. EACOP will have temporary custody of the oil whilst it is in transit whilst the legal ownership remains with the owners of the upstream facilities.

EACOP is owned by its shareholders TotalEnergies (62%), Uganda National Oil Company (UNOC, 15%), Tanzania Petroleum Development Corporation (TPDC, 15%) and China National Offshore Oil Corporation (CNOOC, 8%).

Figure 1.2: EACOP Route Map



Uganda is planning a refinery (up to 60k bopd) which will enable the country to process some of the upstream oil into refined products to be used in the country and reduce imports.

2. GHG-RELATED REQUIREMENTS OF EACOP STANDARDS

EACOP recognises that the project has an impact on the environment and communities that it traverses and is committed to develop the project in a sustainable and responsible manner in compliance with international standards and national laws, regulations, and standards.

2.1. National Requirements

Several Ugandan and Tanzanian climate change commitments and policies are of relevance to GHG management.

2.1.1. Uganda

The 2021 National Climate Change Act gives force to the United Nations Framework Convention on Climate Change, the Kyoto Protocol and the Paris Agreement. It provides a regulatory framework for monitoring, reporting, and verifying climate change impacts and the implementation of climate change programmes. Under the Act, the Government is responsible for producing a framework strategy on Climate Change, National Climate Change Action Plan, Lead Agency Climate Change Action Plan (at the time of writing the lead agency is the Climate Change Department in the Ministry of Water and Environment) and District Climate Change Action Plan. In 2025, the National Climate Change (Climate Change Mechanisms) Regulations, were passed. These regulations describe the mechanism to which a project which would like to reduce its GHG emissions can undertake to contribute to the mitigation of GHG emissions and support sustainable development.

The Act requires the development of further laws which will require companies to prepare mitigation and adaptation plans which present measures to reduce GHG emissions, primarily by reducing energy consumption and using cleaner energy sources, and strategies that enable a business to adjust to the impacts of climate change. Companies will also be required to comply with the procedure for reporting on their performance when prescribed by the Minister. The Government has developed Nationally Determined Contributions (NDC) in terms of the United Nations Framework Convention on Climate Change (UNFCCC) and an implementation plan for the NDCs.

2.1.2. Tanzania

Tanzania has adopted the Paris agreement and also developed NDCs. The third Tanzania National Five-Year Development Plan (FYDP) covering the period 2021/22 – 2025/26 has a strong focus on development of the oil and gas industry, whilst suggesting that renewable energy, including in households, will be pursued to enable an energy transition.

The 2015 National Energy Policy (NEP) strongly focuses on development of the petroleum and gas sub-sector, including developing petroleum infrastructure for refining, processing, liquefaction, transportation, storage and distribution.

The NEP aims at sustainably providing adequate, reliable and affordable energy to the population and allows for scaling up the utilisation of renewable energy and to diversify the country's energy mix. The NEP states several objectives for energy efficiency in industry. The document also addresses strengthening institutional, legal and regulatory frameworks and developing human resource to ensure development of a sustainable energy sector, and promotes compliance with environmental, health and safety standards in the energy sector.

The Government has developed a National Climate Change Response Strategy (NCCRS) 2021 – 2026 (United Republic of Tanzania, 2021), the overall objective of which is to enhance national resilience to adverse climate change impacts and enable the country to pursue low emission development pathways to achieve sustainable development.

Specific objectives include: aligning climate change interventions with the national development agenda of an industrialized economy; enhancing the mainstreaming of climate change issues into national sector and local Government development plans and budgets; facilitating implementation and monitoring of the NDCs; promotion and facilitation of transfer of climate-smart technologies to support climate change adaptation and mitigation and enhancing coordination and institutional capacity, including provision of climate services and implementation of the national framework for climate services.

2.2. Key GHG-Related Requirements of Lender Standards

The EACOP Project will be financed from equity provided by the shareholders and external loans and is being undertaken in compliance with the requirements of the following lender standards with accompanying specific GHG-related requirements relevant to EACOP set out below:

Equator Principles 4 (EP4) (2020):

- Initial projected/forecast emissions will be reported through the assessment documentation.
- Scope 1 and Scope 2 GHG emissions should be calculated in line with the GHG Protocol or national reporting methodologies if they are consistent with the GHG Protocol.
- For projects expected to emit more than 100,000 tonnes of CO_2 equivalent per year (tCO_2e/yr) during the construction and/or operational phases, an evaluation is required of technically and financially feasible and cost-effective options to reduce Project-related Scope 1 and Scope 2 GHG emissions of the project.
- Public disclosure of a summary of such alternative analysis is encouraged.
- The alternatives analysis will include comparisons to other viable technologies, used in the same industry and in the country or region, with the relative energy efficiency, related, generally accepted industry specific GHG efficiency ratios (the level of emissions per unit of measurement e.g., emissions per unit of production), as appropriate, of the selected technology.

Organisation for Economic Co-operation and Development (OECD) Common Approaches Recommendation of The Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence (the Common Approaches) (2016):

- Financial institutions which adhere to the common approaches are required to report estimated GHG emissions for projects with greater than 25,000 tCO_2e/yr. To allow reporting, projects should provide such figures to the financial institutions.
- Financial institutions should also try to report annual operation Scope 1 and Scope 2 emissions and accordingly need projects to provide this data.
- Financial institutions commit to implementing the commitments undertaken by the parties to the United Nations Framework Convention on Climate Change and so will require projects to act accordingly.

International Finance Corporation (IFC) requirements covering the Performance Standards (2012), Environment, Health and Safety (EHS) Guidelines (2007, 2015) and other published guidance:

- Under Performance Standard 3, projects are required to consider alternatives and implement technically and financially feasible and cost-effective options to reduce project related GHG emissions during the design and operation of the project.
- Projects expecting to produce more than 25,000 tCO_2e/yr must quantify Scope 1 and Scope 2 emissions annually, although there is no reporting requirement, projects are encouraged to disclose annual GHG emissions.

This document explains how these Project Lenders' requirements have been met.

3. GHG EMISSIONS SOURCES

Three of the six gases of most concern to the United Nations Framework Convention on Climate Change will be the main gases emitted from EACOP activities – carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), with CO_2 being the most prevalent.

Table 3.1 details the sources of Scope 1, Scope 2, and Scope 3 GHG emissions during the construction and operations phases.

SCOPE	CONSTRUCTION PHASE	OPERATION PHASE
Scope 1	• Diesel powered construction equipment at work sites (MCPYs, construction vessels and associated power generation for installation of marine facilities, above ground installations) and associated infrastructure. • Dedicated transport of equipment, materials, fuel, personnel- from MCPYs to construction sites. • Diesel generators and refrigerants at work sites/camps. • Running of EACOP office, such as company cars. • Land use change e.g., clearance of vegetation (effects on biological carbon stocks resulting from Project activity at work sites and includes both carbon sources and sinks).	• Back-up power generation at PS4, PS5 and the MTT for bulk heating (MTT only), electrical heat tracing, pumping and support systems. • Minor sources of emissions: » Tanker venting during filling at the load out facility. » Fugitive emissions from MTT oil storage tanks. » Intermittent operation of diesel combustion engines at the above-ground installations e.g., firewater pumps and emergency generators. » Road vehicles for equipment and personnel transport.
Scope 2	• Electricity purchased from the Ugandan and Tanzanian energy companies.	• Electricity purchased from the Ugandan and Tanzanian energy companies.
Scope 3	• Extraction, production, and outsourced transport of purchased materials e.g. line pipe, LOF and trestle (marine facilities), food and fuel. • Transportation of personnel by transport not owned or controlled by EACOP or Contractors. • Running of thermal insulation system (TIS). • Third-party transport of Contractor waste. • Power for contractor offices, warehouses, driver overnight rest areas. • EACOP Corporate air travel, light vehicles, field team hotel accommodation, Corporate level contractors site equipment, office power and air travel. • Associated Facilities e.g., Tilenga construction, Kingfisher construction, concrete batching plants, borrow pits.	• Upstream: » Tilenga and Kingfisher production and processing and feeder pipelines. • Downstream*: » Shipping crude oil to export markets. » Crude oil refining. » Transport of the refined product from the refinery to the point of sale. • Combustion of refined products. **EACOP only has custody of the oil whilst it is in transit through the EACOP pipeline system, the legal ownership remains with the upstream owners up until the point of transfer of ownership at the Jetty loading arm flange.*

4. GHG SCOPE 1 AND SCOPE 2 EMISSIONS ALTERNATIVES AND EVOLUTION OF CARBON FOOTPRINT REDUCTION

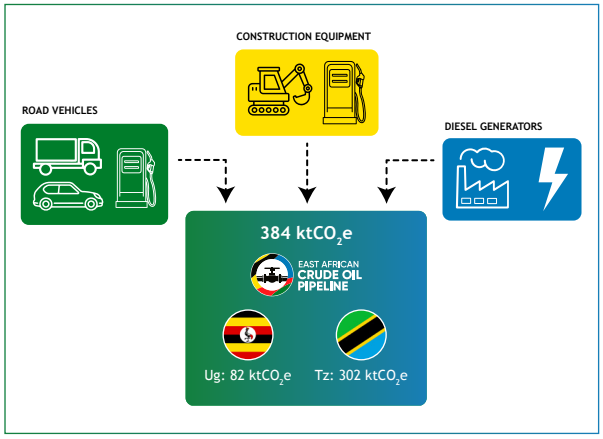
EACOP is considered as a project in a high carbon intensity sector and is expected to emit more than 100,000 tCO_2e/yr during the construction and/or operations phase. In accordance with the EP4 requirement, an alternatives analysis had been performed for Scope 1 and Scope 2 emissions. For Scope 1 emissions, this alternatives analysis endeavoured to identify the best practicable environmental option and included consideration of alternative energy sources. Comparisons were not limited to the same industry, country or region as there is not a similar pipeline in the region (similar length, with electrical heat tracing) and renewable energy has not been used at this scale for oil and gas facilities to provide power.

Several viable technologies were reviewed, and a Best Available Technology (BAT) study was conducted to screen various technologies, including the efficiency of these technologies in reducing GHG emissions. Several renewable energy sources were studied such as geothermal, onshore wind and solar. Initially, connection to the national grid had been disregarded due to quality issues but later considered after some major progress in engineering. The following sections describe the evolution of the engineering as well as efforts made by EACOP to decrease Scope 1 and Scope 2 GHG emissions during construction and operations. Since Scope 3 emissions are outside the control and management of EACOP, it is not feasible to include such emissions in this alternatives analysis.

4.1. Construction Phase Scope 1 GHG Emission Estimates and Reduction Measures

Scope 1 emissions over the four-year construction period will originate mainly from burning of fuels with some from land use change. Such emissions were quantified by categories of work and then converted into GHG emissions by multiplying the activity data and standard emission factors for a set amount of that activity derived from widely accepted international sources - the GHG Protocol, American Petroleum Institute (API), International Energy Agency (IEA), European Environment Agency (EEA). The construction emissions forecast presented in the Uganda ESIA was refined based on more precise estimates of fuel consumption and an estimate was calculated for Tanzania. The forecasts at the time of writing are presented in Figure 4-1 below (in thousand tonnes of CO2 equivalent - $ktCO_2e$), the higher emissions in Tanzania reflect the greater level of construction activity due to the lengthier pipeline and more above ground facilities in this country. Estimates of GHG emissions linked to land use change are being developed.

Figure 4.1: Construction Phase Scope 1 GHG Forecasting



As defined in the ESIAs, GHG emissions reduction measures during the construction phase consist of ensuring that:

- Vehicles, machines, and equipment:
  - Are appropriate for the task required.
  - Have a proper maintenance and inspection certificate and logbooks.
  - Are allocated a unique identifier to be used in a maintenance log.
  - Are maintained regularly in accordance with the manufacturer's recommendations to maximise fuel efficiency and help reduce emissions.
  - Are not allowed to idle - engines are switched off when not in use.
- All combustion plant meets relevant national regulations and project environmental standards.
- Construction vessels have International Air Pollution Prevention Certificates confirming compliance with MARPOL 73/78 Annex VI addressing equipment used and operational activities.

- Vessels and equipment are serviced in accordance with the manufacturer's recommendations and have up-to-date service records available for inspection.

Although most of the area cleared for construction will be allowed to re-vegetate, mitigation measures have also been identified to reduce the emissions related to vegetation clearance through minimising the project footprint, reinstating temporary working areas, minimising the time between site clearance and reinstatement to more quickly re-establish carbon capture / storage potential and implementing opportunities to minimise vegetation loss (in areas of high biodiversity value).

4.2. Operations Phase Alternatives and GHG Emissions Estimates

The main source of direct GHG operations emissions at the time of the ESIAS in 2018 - 2019 were considered to be the crude oil power generation units at two PSs and the MTT as well as the direct-fired heaters at the MTT.

Since that time, EACOP has made significant progress in lowering the operations phase carbon footprint through the use of solar power in Tanzania together with connections to the national electricity network in both Uganda and Tanzania which is supplied from lower-emissions sources, especially in Uganda. This section details the operations GHG management alternatives analysis and design optimization with a comparison of the GHG emissions for the design cases at the end illustrating the progress that has been made towards GHG reduction.

4.2.1. Earliest Engineering Design

In the earliest design stages, technology alternatives not directly related to power generation were considered which have implications for GHG emissions:

- Insulation - Early studies concluded that heat losses with un-insulated pipe would require 35 separate heating stations resulting in high power demand (at the time to be supplied by crude oil powered heaters) with associated emissions. The use of thermal insulation on the pipeline reduced the power demands for heating.
- Heating – Options were evaluated for maintaining the required oil temperature involving electrical heat tracing only, bulk heating only and a combination of the two. The latter option was selected requiring power for the two systems with attendant emissions.
- Pumping Stations – Studies undertaken to optimise the number and location of the PSs concluded that it was feasible to reduce the number of PSs from seven to six by relocating PS3 and PS4 in Tanzania thereby removing an emissions source.

4.2.2. Case 0: Used for EACOP ESIAs (2018-2019)

In the case 0, bulk fired heaters at each PS and the MTT were considered to manager the temperature losses in the pipeline, especially when the production was decreasing.

At the time of the ESIAs, a number of power supply options were considered as part of the early engineering studies.

For Uganda, the initially proposed power supply was stand-alone power generation from crude oil-fired equipment at PS1 and PS2. An optimisation study concluded that power could be supplied from the central processing facilities (CPFs) for the two upstream projects due to the availability of excess gas in the initial production stage with a reduction in emissions (gas instead of crude oil), potentially coupled with power import from the Uganda National Grid.

In Tanzania, several power generation alternatives were considered covering a self-sufficient power supply using crude from the pipeline (crude oil powered engines; crude oil powered engine with additives or blending; steam or organic Rankine cycle turbines; local treatment of crude (semi-centralised topping); decentralised topping and transport by pipeline) and imported power (gas oil; self-generated electricity; grid electricity; gas and solar). From this study it was determined that EACOP would be autonomous in electricity generation, with power generation units burning crude oil from the pipeline located at PS4 and PS5. This decision was based on concerns at the time on the capacity and reliability of the grid and the conclusion that the Project required independent power generation to operate reliably, availability of infrastructure and technology and impacts associated with traffic, noise, dust and emissions.

A carbon footprint reduction opportunity was identified through the use of solar power for operation of the mainline block valves (MLBV) and MLBVs located adjacent to an electrical substation would take power from that facility.

GHG emissions from other operations sources e.g., emissions from passenger vehicles, were considered negligible in comparison to power supply emissions. Consequently, such sources were not considered further throughout all the carbon footprint reduction studies.

4.2.3. Case 1: Reference Case (2020)

After the ESIAs, EACOP undertook further studies to refine and optimise the operations equipment which resulted in a significant reduction in GHG emissions and the Project's carbon footprint. Since the refined engineering information allowed a more precise and robust calculation of GHG emissions, Case 1 is being used as the reference case for GHG emissions comparison and optimisation.

In Uganda, further investigations indicated that the power supply from the upstream CPFs was insufficient after 7 years of operations and it was determined that the electrical section in Uganda, including PS1 and PS2, would be powered by electricity from the national grid. PS1 will be physically connected to the grid whilst PS2 will receive power routed from PS1, using underground EACOP power cables. Since more than 90% of electricity in Uganda is generated from hydroelectric plants this presents a significant reduction in GHG emissions. There is also a shift from Scope 1 to Scope 2 emissions. Back-up power would be provided by surplus power from the CPFs to maintain oil flows during periods when the electricity supply from the grid is disrupted. Accordingly, this scenario presents a good solution for the carbon footprint of power supply in Uganda. Initially, GHG emissions from the power supply from the CPFs were considered as part of the Upstream emissions calculations, to prevent double counting.

Bulk heaters at all the PSs were removed as part of optimization work (heaters at the MTT remained as required to heat up the oil prior to storing in the crude storage tanks to avoid wax deposition on the tanks wall and bottom that would form unpumpable residues).

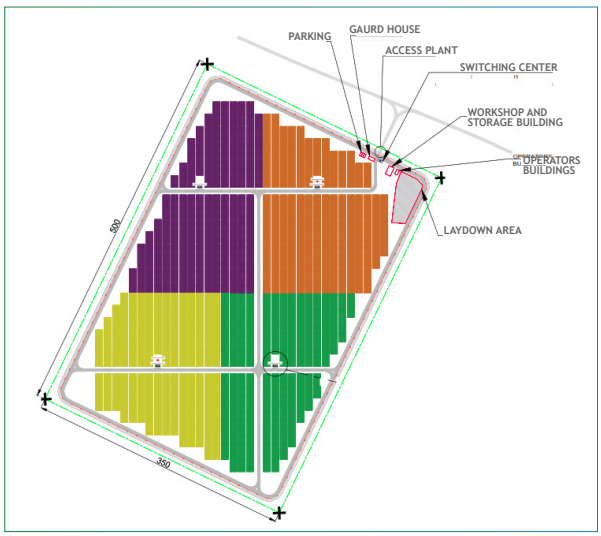
4.2.4. Case 2 (2021 - 2022)

Following on from Case 1, studies continued to build upon the GHG reductions achieved.

In Tanzania a BAT study was initiated to analyse and quantify the alternative power supply options with fewer emissions – connection to the electricity supply grid and renewable energy. Whilst electricity in Tanzania is generated from natural gas, hydropower, petrol, solar and biofuels, supply of electricity from the grid was discounted for this case as the supply was still found to be too unreliable for EACOP needs.

Screening of renewable technologies in Tanzania covering wind, geothermal, and solar generation indicated solar to be the best renewable option due to the high levels of available solar energy and reasonable costs. A 2021 detailed feasibility study confirmed that solar farms coupled with battery energy storage systems (BESS) would allow a reduction of power generation GHG emissions by 30% through substitution of power from the crude-oil powered generators. Five solar farms would be installed on land temporarily used by the Project contractors during construction - Main Camps and Pipe Yards (MCPYs) - and at a site within the MTT. Solar farm installation would follow on from decommissioning of the MCPYs by the construction contractors. Figure 4-2 presents an example of a solar farm layout and racking system.

Figure 4.2: Example of Solar Farm



The maximum contribution to power supply from the solar farm / BESS option in Tanzania is constrained by:

- The surface available (the EACOP commitment is to limit the land requirements as much as possible).
- The minimum power generated by crude oil generators (minimum number of generators to run and minimum workload to operate in a sustainable manner), the need for the crude oil generators to produce at least a minimum

power output to operate in a sustainable manner (minimum number of generators to ensure coverage during cloud events, for supply of minimum power to sensitive equipment, and minimum required workload for each generator to reduce emissions and fouling).
- The fact that solar power is intermittent (e.g., no solar power at night) and the fact that a BESS system to store the full energy required at night would not be economically feasible.

Thus, the Tanzanian solar farms with BESS are not suitable to meet all the power requirements, supplying 30% of the power requirement, and a complimentary power source is still required – crude oil generators at PS4, PS5 and the MTT remained part of this case.

4.2.5. Case 3: Current Case (2023)

The present-day case has evolved after looking at further opportunities for carbon footprint reduction, focusing on Tanzania as no further significant GHG reduction opportunities were identified for Uganda. The Uganda plan for PS1 and PS2 to be powered by green energy from the national grid with back-up power from the upstream facilities in times of disruption to the electricity supply remains in place.

A feasibility study on additional electricity grid connections was undertaken following upgrades to the network and the announcement of investment plans for the system from the Government body responsible for electricity generation, transmission and distribution - Tanzania Electric Supply Company Limited (TANESCO). In particular, a new hydropower plant (Julius Nyerere Hydraulic Power Dam) is now complete and became fully operational in 2025. The operation of this dam will significantly reduce GHG emissions related to electricity production and the associated grid emission factor (the amount of carbon emissions per unit of electricity generated).

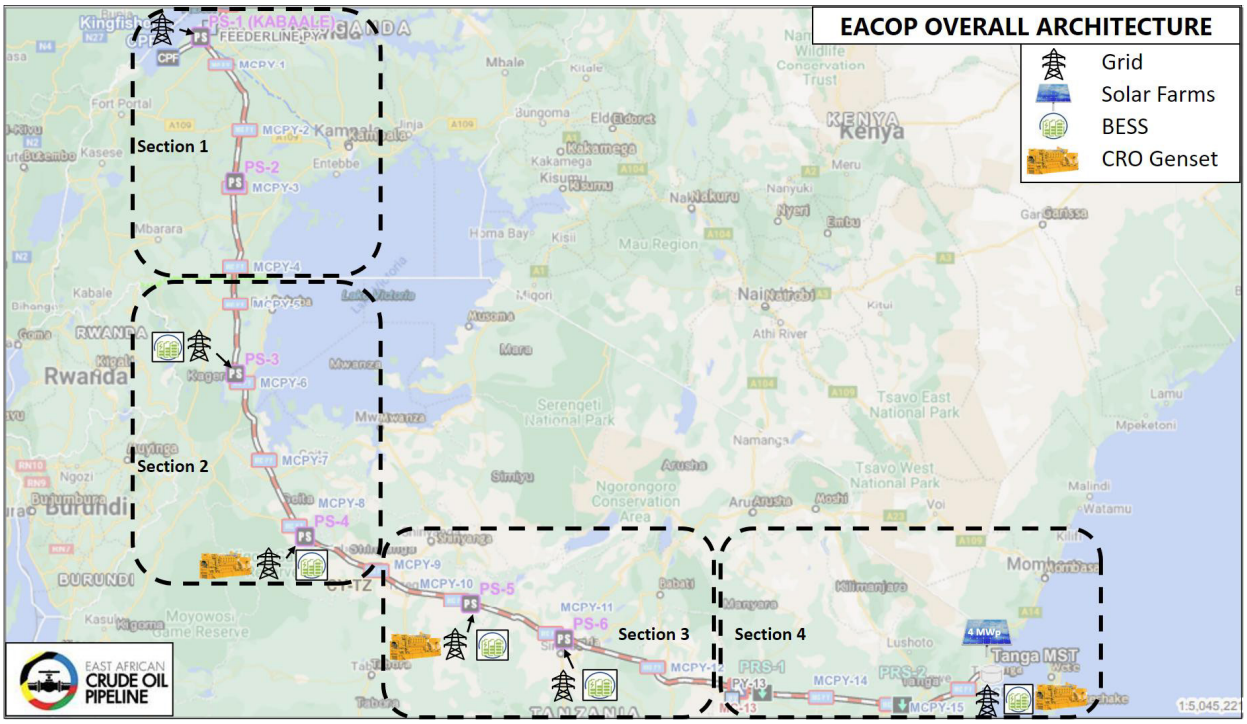
The TANESCO improvements increase the capacity and reliability of the grid supply which had led to the rejection of this option as part of the Case 0 studies. In co-operation with TANESCO, EACOP also performed grid quality studies in 2022 and 2023 to confirm the grid characteristics and identify measures that would be required to ensure that the Project's availability and reliability requirements could be met. Investigations indicate that good reliability of the electricity supply network can be assumed with a conservative estimate of 5% network unavailability requiring back up from the crude oil generators. There is, however, high probability of grid instability which is unpredictable in terms of voltage, amplitude and duration.

These studies identified that planned TANESCO infrastructure development could supply the Project with grid connections at the four PSs (PSs 3 - 6) and MTT, provided that a BESS is installed at each of the PSs and the MTT to address periods of grid instability (voltage drop, short duration black-out). This would ensure that the export pumps would operate until crude oil generators were started to maintain the oil flow during a significant event on the grid. Project basic engineering studies commenced towards the end of 2023 to independently confirm the feasibility and reliability of the connections and provide the associated design of the tie-ins to the grid. It is to be noted that the grid can only be used with the application of significant compensation measures such as the BESS and protection systems to protect EACOP sensitive electrical equipment.

It is considered that the hybrid power generation solution of Grid / BESS in Tanzania and Grid in Uganda is the best option taking into account the considerably lowered carbon footprint of the power supply (see Section 4.3), especially in Uganda, feasibility and cost-effectiveness (presented in Figure 4-3). Crude oil power generation units would be installed as a back-up in Tanzania at PS4, PS5 and the MTT in the event of a significant disruption to the grid supply, assumed to be required for 5% of the time.

At the MTT, a 4 megawatt peak (MWp) photovoltaic (PV) farm will be erected on available land to support the recharging of the BESS. Since the increase in power supply from the grid requires less solar power inputs, solar power generation is consolidated at the MTT and there are currently no planned solar farms at the MCPYs. With the operation of the Julius Nyerere Hydraulic Power Dam and the reduction in the grid emission factor making the Tanzanian grid relatively 'green', the benefit of EACOP developing more solar farms is minimal in terms of reducing Scope 2 emissions.

Figure 4.3: Power Supply Case 3 (current case)



4.3. Carbon Footprint Reduction Evolutions

Since, with use of power from the grid in Uganda, operational GHG emissions from the Tanzania portion of the Project account for the majority of GHG emissions, the carbon footprint reduction measures discussed above are aimed at Tanzania. Table 4.1 presents the evolution of the contributions from the three power sources for each of the cases, showing the maximum technically feasible contribution from solar / BESS and with power being supplied from oil-fired generators for the assumed precautionary 5% of the power requirement when the electricity supply grid is unavailable.

Table 4.1: Power Supply Contributions for Operations Cases - Uganda and Tanzania

CASE	UGANDA	TANZANIA
Case 0	Power requirements provided by upstream, bulk heaters at PS-1 and PS-2	Engines at PS-4, PS-5 and MTT, bulk heaters at all pumping stations and MTT
Case 1	100% of power requirements supplied from grid	Engines at PS-4, PS-5 and MTT, bulk heaters at MTT
Case 2	100% of power requirements supplied from grid	Power from solar farms / BESS at PSs (30%) Engines provide remaining power requirements (70%) Bulk heaters at MTT
Case 3	100% of power requirements supplied from grid	Tanzania electrical grid provides majority of power requirements (93%) Engines provide remaining power requirement to cover unavailability of national grid (7%) Solar farm at MTT/BESS at PSs (back-up power) bulk heaters at MTT

The consideration of power generation alternatives has resulted in a reduction in operations GHG emissions in the order of 40 – 50% compared to Case 1, depending on the carbon emissions of the grid in Tanzania. Several inputs to this calculation will be confirmed in ongoing power studies - the power consumption of equipment, availability of accurate information for the Tanzanian grid and the significant change in the Tanzanian grid emission factor due to the hydropower project when it will start producing electricity (335g CO_2e per kilowatt hour (kWh) in 2021 (IEA, 2022) and estimated by EACOP to drop to 175g CO_2e/kWh). The GHG four-year construction and lifetime operations emission estimates are presented in Tables 4.2 - 4.4 annual emissions vary with the level of construction activity and with flows and the associated power demand during operations. Annex B provides details of the calculation methodology used. It should be noted that the values are conservative, and that Case 3 will continue to be developed to try and reduce GHG emissions further.

Table 4.2: GHG Emissions (in $KtCO_2e$) for Four-year Construction Period

GHG SCOPE TYPE	CONSTRUCTION GHG EMISSIONS $KtCO_2e$	
	UGANDA	TANZANIA
Scope 1	82	302
Scope 2	0.01	2.32
Total Scope 1&2 for each country	82.01	304.32
Total Scope 1 (Uganda & Tanzania)	384	
Total Scope 2 (Uganda & Tanzania)	2.33	
Total Scope 1 & 2 (Uganda & Tanzania)	386.33	

Table 4.3: GHG Emissions for Lifetime Operations Cases

COUNTRY	SOURCE	LIFETIME OPERATIONS (25 YEARS) SCOPE 1 & 2 GHG EMISSIONS $ktCO_2e$			
		CASE 0[a]	CASE 1	CASE 2	CASE 3
Uganda [b]	**Scope 1:**				
	Power Generation	225	–	–	–
	Heaters		–	–	–
	Diesel		21.8	21.8	21.8
	Fugitives		0.02	0.02	0.02
	Scope 2:				
	Grid Import	–	21.3	21.3	21.3
	Total Uganda	**225**	**43.1**	**43.1**	**43.1**
Tanzania	**Scope 1:**				
	Onsite Power Generation	**5,025 - 7,050**	7,496	5,791	**467.1**[c]
	MTT Heaters		970.5	970.5	970.5
	Diesel		119.9	119.9	119.9
	Fugitives		0.04	0.04	0.04
	Oil Storage Tanks		10.7	10.7	10.7
	MTT Storage		140.4	140.4	140.4
	Tanker Loading		98.2	98.2	98.2
	Scope 2:				
	Grid Import	–	–	–	**3,203**[e]
	Total Tanzania	**5,025 - 7,050**	**8,836**	**7,131**	**5,010**
Total Operations Scope 1 (Uganda & Tanzania)		5,250 - 7,275	8,858	7,153	1,829
Total Operations Scope 2 (Uganda & Tanzania		0	21.3	21.3	3,224
Total Operations Scope 1&2 (Uganda & Tanzania)		5,250 - 7,275	8,879	7,174	5,053

[a] *The GHG emissions value for Case 0 in Tables 4.2 and 4.3 is an indicative value derived from the EACOP ESIA completed in 2019. The calculation methodology for Case 0 is different from Case 1 to Case 3.*

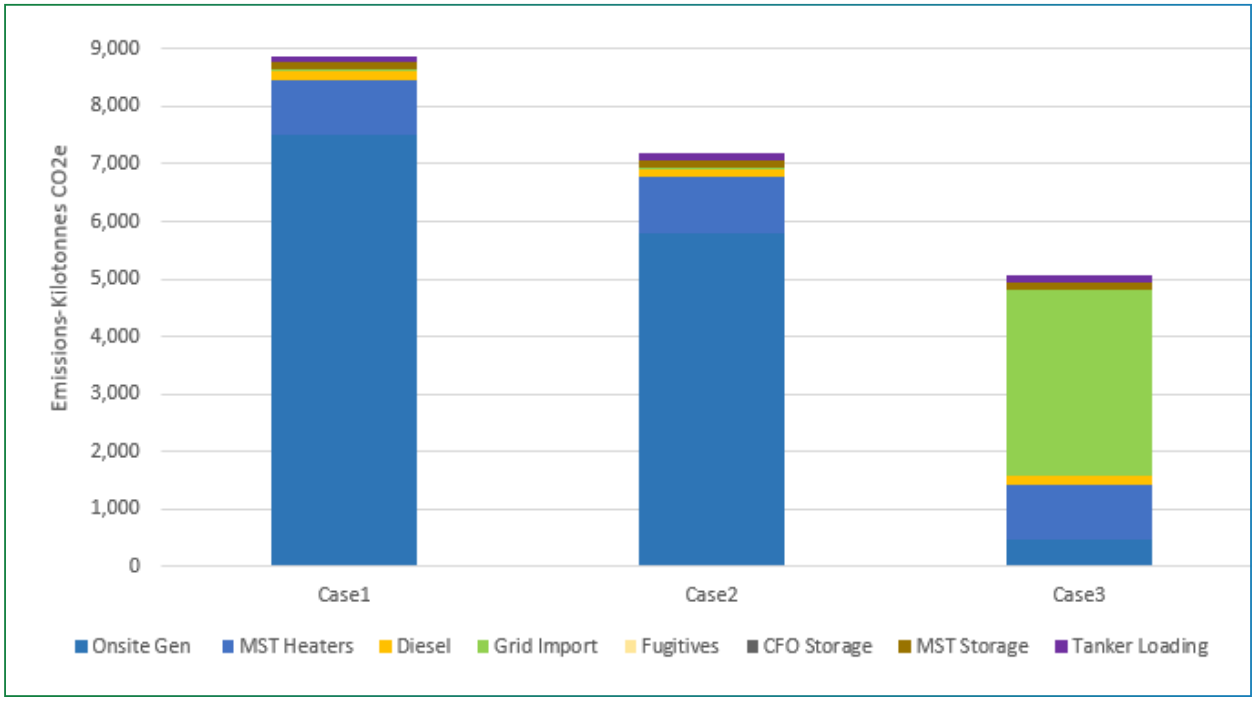
[b] *If utilised in Uganda, back-up power supply from upstream CPFs will be accounted for in the upstream emissions.*

[c] *It has been assumed that generators would operate to cover all of a period of grid instability (assumed at 5% of operational time). In practice, solar / BESS would operate for short periods of grid instability before the generators were working at full capacity. This contribution of solar to the power supply would be minimal and has not been taken into account in the calculations.*

[e] *Does not assume electricity supply from the new hydropower scheme. Tanzania Scope 2 emissions will decrease when this scheme is considered.*

Figure 4.4 Lifetime Operations GHG Emissions from Power Supply Alternatives

Figure 4.5 illustrates the contributions of the sources to Scope 1 and 2 emissions over the operational life of the pipeline for the power supply alternatives.



4.3.1. Benchmarking of EACOP GHG Intensity

In accordance with the considerations for the alternatives analysis in the EP4 Guidance Note on CCRA, EACOP has evaluated how the Project compares to similar assets. This helps to determine if the project has been designed to operate efficiently from an emissions perspective. Table 4.5 presents EACOP Scope 1 and Scope 2 GHG emissions intensity for the peak pipeline flow (amount of GHG emissions produced per unit of oil transported through the pipeline per kilometre) and Table 4.6 compares this EACOP GHG emissions intensity with other long distance oil pipelines. To ensure that the comparison is equitable, emissions relating to the MTT (MTT heaters, diesel usage, oil storage tanks and MTT storage) have been excluded from emissions intensity calculation. On average, piped oil emissions are around 0.00119 kilograms of CO_2 equivalent per barrel of oil equivalent per kilometre ($kgCO_2e/boe/km$) (Rystad Energy). The comparison demonstrates that EACOP Case 3 GHG emissions intensity is the same as the average emissions.

Table 4.4: GHG Emissions for Four Year Construction and Lifetime Operation Cases

GHG SCOPE	FOUR YEAR CONSTRUCTION & LIFETIME OPERATIONS (25 YEARS) SCOPE 1 & 2 GHG EMISSIONS $KtCO_2e$			
	CASE 0[a]	CASE 1	CASE 2	CASE 3
Total Scope 1 (Uganda & Tanzania)	5,634 - 7,659	9,242	7,537	2,213
Total Scope 2 (Uganda & Tanzania)	2.33	23.63	23.63	3,227
Total Scope 1 & 2 (Uganda & Tanzania)	5,636 - 7,661	9,265	7,560	5,439

Figure 4.5: Annual Operations GHG Emissions from Tanzania Power Supply Alternatives

Figure 4.4 further illustrates that the continued application of BAT has significantly reduced annual Scope 1 and 2 GHG emissions.

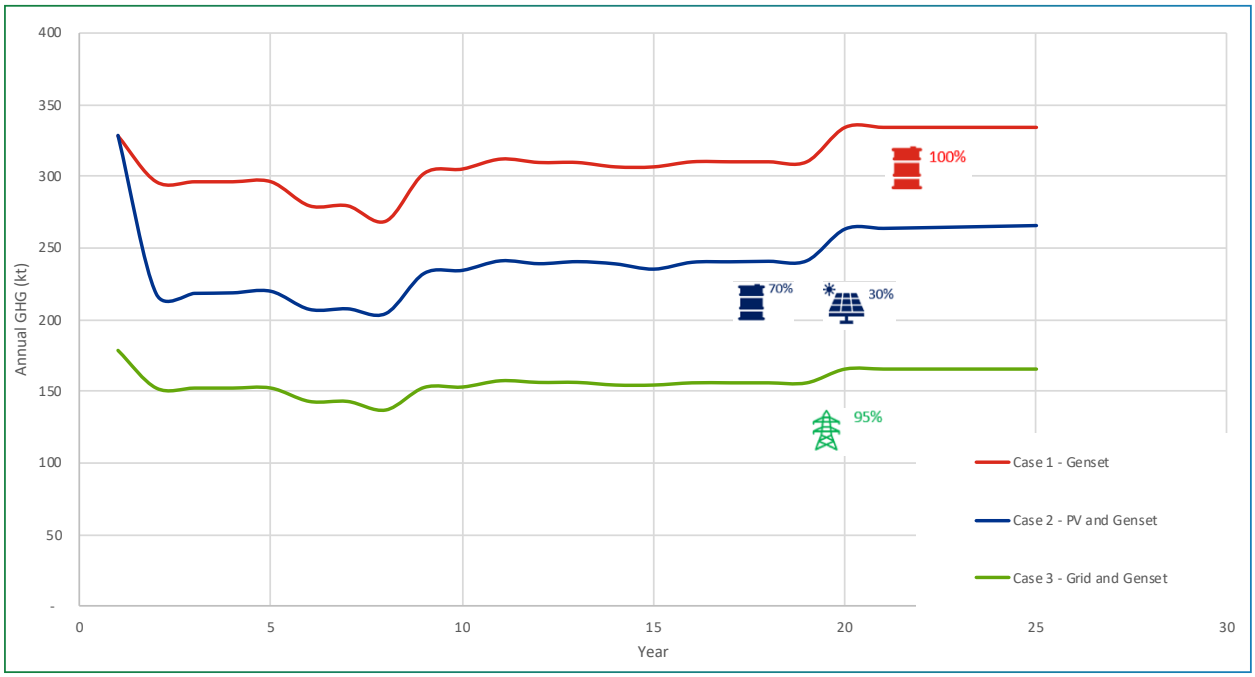


Table 4.5: EACOP GHG Emissions Intensity

EACOP CASE	PIPELINE LENGTH (km)	OIL VOLUME TRANSPORTED (Thousand barrels of oil equivalent per day)	GHG EMISSIONS* (Thousand tonnes of CO_2 equivalent / yr - $ktCO_2e$ yr)	GHG EMISSIONS INTENSITY ($kgCO_2e$/ boe/km/year)
Case 1	1443	246	288	0.0022
Case 2			211	0.0016
Case 3			144	0.0012

** Maximum flow rate (years 2 - 6)*

Table 4.6: Comparison of Oil Pipeline GHG Emissions Intensities

OPERATING PIPELINE PROJECT	REGION	GHG EMISSION INTENSITY ($KgCO_2e$/boe/km/year)
Magellan	North America	0.00155
TransCanada (TC) Energy	North America	0.00093
Enbridge	North America	0.00142
Transmountain	North America	0.00084
Average of Operating Projects		0.00119
EACOP Case 3 – current case	Africa	0.0012*

Source: Rystad Energy

**Other pipelines used for comparison purposes do not include storage facilities. To ensure that the comparison is equitable, emissions relating to the MTT (MTT heaters, diesel usage, oil storage tanks and MTT storage) have been excluded from the above emissions intensity calculation.*

Over its expected 25-year operational life, the cumulative Scope 1 and Scope 2 emissions associated with EACOP are estimated at approximately 5,439 ktCO2e, in line with Table 4.4, which reflects GHG emissions for the three-year construction phase and lifetime operations (Case 3: Construction and Field Operations). During the first 20 years period, the pipeline is projected to transport about 1 billion barrels of oil to Tanga, including five years at plateau production of up to 246,000 barrels per day. This results in an average Scope 1 and Scope 2 emissions intensity of approximately 4.4 kg CO2e per barrel transported over the 20 years period, and 2.2 kg CO2e for the years at plateau production.

The combined EACOP and upstream projects demonstrate strong performance in emissions management, with an estimated Scope 1 and 2 emissions intensity of 13 kg CO2e per barrel of oil equivalent (boe) (https://totalenergies.com/system/files/documents/2022-12/Tilenga_EACOP_TotalEnergies_projects.pdf). This positions the project among the lowest-emitting oil developments in Africa, where the regional average stands at 33 kg CO2e/boe (Wood Mackenzie). On an even broader scale, barrels transported through EACOP carry a significantly lower carbon footprint compared to barrels sourced from other globally, as illustrated in Table 4.4: (Comparison of Oil Pipeline GHG Emissions Intensities). Importantly, without the EACOP pipeline, the global demand for oil would still be met by production from fields with much higher carbon intensity, resulting in greater overall emissions. EACOP's lower-carbon barrels represent a meaningful step toward reducing midstream emissions associated with meeting global energy needs

4.4. Further Carbon Footprint Reduction Opportunities

Opportunities are still being explored to reduce Scope 1 GHG operations emissions even further, some of them being:

- Use of renewable sources of energy to reduce the use of direct fire heaters at the MTT.
- Improving the sourcing of electricity in Tanzania with certified renewable energy sources.
- Further use of renewable energy at EACOP facilities.

An Operations Energy Management System will be in place incorporating procedures and processes to manage pipeline activities in line with the widely accepted International Standards Organisation (ISO) ISO50001 Energy Management System standard. This standard is a strategic tool that helps organizations put in place an energy management system and use their energy more efficiently and effectively. Control measures will include conducting regular energy audits at the pumping stations to ensure pumps operate at peak efficiency.

Carbon footprint compensation opportunities are also being considered, including:

- Green carbon offsets: forest restoration / tree growing in Uganda and Tanzania.
- Blue carbon offsets: seagrass restoration in Tanzania.

In addition, EACOP will also support both Governments on climate change adaptation and mitigation strategies, including promoting agroforestry and introducing climate-smart agricultural techniques. The Tanzanian Ministry of Energy Power System Master Plan 2020 update involves the development of gas and coal fired power plants over the long term. Such developments would result in increases in the grid emission factor (possibly up to 420g/kWh) from 2032 when the new fossil fuel power plants begin operation.

In such a scenario, solar farms would be installed at MCPYs 6/8/10/11 as well as the MTT to reduce Scope 2 emissions and maintain the level of GHG reduction achieved by Case 3 in comparison to Case 1. In such a case, it is anticipated that the contributions from each element of the power supply system will be: 65% electricity grid connection; 30% solar power / BESS and 5% engines. During operations, EACOP will monitor development of the Tanzania power supply sources and changes in the grid emission factor and determine whether installation of further solar farms or alternative energy supply options would be required to maintain the GHG reductions.

5. CRUDE OIL LIFECYCLE GHG EMISSIONS

As explained in Section 1, the EACOP pipeline is purely a conduit to provide transport of oil produced by the Tilenga and Kingfisher upstream projects in Uganda; it will, at no time, have legal ownership of the oil, only temporary custody of the oil whilst 'in transit' and the legal ownership remains with the owners of the upstream facilities.

EACOP Scope 3 indirect emission sources are detailed in Table 3.1 in Section 3.0, the main ones being:

- Upstream Scope 3 emissions linked to crude oil production from the fields supplying the pipeline.
- Downstream Scope 3 emissions from further transport of crude oil product (shipping to export markets), crude oil refining, refined product transport and refined product combustion.

Emissions from venting, flaring and production and upgrading of oil upstream of the pipeline are in the order of double the operational emissions from EACOP. Downstream, the most significant Scope 3 source is that of emissions from the end use of the refined petroleum products. These downstream Scope 3 emissions vastly exceed Scope 1 and 2 emissions from EACOP construction and operations. In the context of wider emissions, the EACOP contribution is minimal.

The alternatives analysis required under the EP4 guidance for a CCRA can consider Scope 3 emissions as appropriate. The upstream projects have completed alternatives analysis as part of their project designs. It is not feasible for EACOP to consider alternatives for Scope 3 construction emissions or for Scope 3 downstream emissions.

6. COMPATIBILITY WITH HOST COUNTRY CLIMATE CHANGE COMMITMENTS AND POLICIES

The CCTRA also considered the alignment of the Project with Uganda and Tanzania's climate change commitments and concluded that the EACOP was compatible with both Uganda and Tanzania's national climate change commitments, National Development Plans or Energy Policies, that it will make a relatively minor contribution to the host countries' emissions and that it would be unlikely to prevent the countries meeting their targets. This compliance is detailed in the sections below.

There is strong regulatory and political support in both host countries for the development of the oil and gas sector, as demonstrated by the Host Government Agreements (HGAs) with the Government of Uganda and the Government of Tanzania and the Inter-Governmental Agreement (IGA) between the two Governments. Each State has passed, after Parliamentary approvals, the enabling legislation in relation to its HGA.

6.1. Uganda

The Climate Watch online open data platform managed by the World Resources Institute ranks Uganda as the World's 83rd largest emitter and that in 2022, Uganda emitted 53.61 million tonnes of carbon dioxide equivalent ($MtCO_2e$), equating to 1.17 tCO_2e per capita and representing 0.13% of global emissions that year. Agriculture was the leading source (50.4%) followed by land use change and forestry (26%) and energy (18.4%) with waste and industrial processes accounting for the remainder. The International Centre for Tropical Agriculture reports that agriculture sector GHG emissions are driven by four main sources: production of methane from digestion in livestock, manure left on pastures, burning grassland and the cultivation of organic soils. The Ugandan Government notes that forest covers 11.66% of the country and is declining due to deforestation at an annual rate of 1.44%. Biomass accounts for more than 89% of total primary consumable energy, the remainder (10%) comes from liquid fuels (e.g., gas/diesel oil) and solid fuels (1%).

Uganda's third National Communication to the UNFCCC covering the period 1995 – 2017 reported that CO_2 accounted for more than 98% of emissions for the latest report which appears to be available.

Uganda has formulated an economy wide Long-Term Low Emissions Development Strategy to ensure the alignment of long-term climate change strategies with short and medium-term climate actions to represent the country's contribution and the fair share of domestic effort to transition to a low-carbon and climate-resilient economy in the near future. Uganda has also produced an Agriculture Sector Long Term Low Emissions and Climate Resilient Development Pathway.

Uganda's 2022 NDC report sets out targets, measures and actions detailing the domestic mitigation and adaptation measures aimed at achieving the objectives of the Paris Agreement. The country commits to implement policies, measures and interventions in the agriculture, forestry and other land use (AFOLU), energy, waste, transport, and industrial processes and product use (IPPU) sectors that will result in a 24.7% reduction of national GHG emissions below the 2030 Business-As-Usual (BAU) scenario (148.8 $MtCO_2e$), to 112.1 $MtCO_2e$ in 2030. The largest contribution to the mitigation package will come from the AFOLU sector - 82.7% - while 7.56%, 6.36%, 3%, and 0.4% will come from the transport, energy, waste, and IPPU sectors, respectively.

Scope 1 EACOP construction emissions total 82 $ktCO_2e$ over a 3-year period and represent a small proportion of both the 2030 BAU emissions and the emissions under the NDC 2030 emission reduction scenario, being less than 1% of national emissions. Furthermore, these occur before 2030 and so will not affect Uganda meeting the 2030 NDC target.

Scope 1 and 2 operational emissions will be between 1.29 and 2.21 $ktCO_2e/yr$ depending upon flows and power demand. These emissions represent a negligible fraction of both annual BAU and target emissions and so are not likely to affect meeting the reduction targets. Emissions from any back-up power supplied by the upstream projects will be considered in their GHG emissions accounting.

The broader national planning context is set out in Uganda's third National Development Plan (NDP) 2020/21 - 2024/25 which identifies development of the oil and gas sector as a significant contributor to economic development in the country.

The NDP highlights a selection of liquefied petroleum gas (LPG) and carbon offset projects to address climate mitigation and recognises the establishment of renewable (largely hydroelectric) supply options to meet the need for clean and affordable supply of electricity to the under-served population. EACOP is not in contravention of Uganda's national climate change commitments, national development plans or energy policies.

6.2. Tanzania

Tanzania is ranked as the 46th largest World emitter on the Climate Watch portal emitting 158.82 $MtCO_2e$ in 2021 with a rate of 2.66 $MtCO_2e$ per capita which represents 0.33% of global emissions. Land use change and forestry was the main source (42.81%) with agriculture (37.35%) and energy (13.67%) accounting for other key sources. (with waste and industrial sources making a minor contribution to GHG emissions).

As reported in Tanzania's Second National Communication to the UNFCCC, CO_2 was by far the dominant GHG, comprising 87.1% of GHG emissions in 2000 (the latest statistics that EACOP has been able to obtain).

Approximately 90% of Tanzania's energy needs are met by biomass, with commercial energy, such as liquefied petroleum products providing 8%, electricity 1.5% and other sources such as coal, wind, and solar energy 0.5%. Agriculture and land use change and forestry emissions include livestock production, fermentation, manure management, agricultural soils emissions from the field burning of agricultural residues, rice cultivation and savannah burning. Tanzania has 35.3 million ha of forests, one of the highest forest covers in Eastern and Southern Africa. The forests are a carbon sink, absorbing all emissions produced at national level and more, making Tanzania a net GHG sink.

According to the 2021 NDC report, Tanzania will reduce GHGs economy-wide between 30 - 35% relative to the BAU scenario by 2030, involving a reduction of 138 - 153 $MtCO_2e$ gross emissions, depending on the baseline efficiency improvements. Priority mitigation sectors are energy, transport, forestry, and waste management. The NDC is in line with the Tanzania Development Vision (2025) and Zanzibar Development Vision (2050), and the Third Five Year Development Plan 2021/22–2025/26 (FYDP III). The NDC is also anchored in the National Climate Change Response Strategy (2021) and the Zanzibar Climate Change Strategy (2014) which contain adaptation measures and mitigation actions required to address climate change in the country.

The 302 $ktCO_2e$ Scope 1 construction emissions spread over four years, do not affect the attainment of the 2030 NDC target. The Scope 1 and 2 operational emissions contribution ranging from 184 to 231 $ktCO_2e/yr$ varying with flows and power demand, represents a small contribution to national emissions and thus will not significantly impact the ability of Tanzania to meet its NDC target.

EACOP is aligned with the Tanzanian climate change commitments, development plans and energy policies.

7. GHG REPORTING

7.1. EACOP 2023 GHG Emissions

EACOP has calculated 2023 and 2024 total GHG emissions and reported the figures to Government agencies on a quarterly basis. In 2023, EACOP generated 9.27 ktCO2e, primarily from fuel consumption by vehicles and construction equipment used at early work construction sites. In 2024, EACOP generated 22.74 ktCO2e, from fuel consumption used for early civil works.

7.2. Construction GHG Reporting

Quarterly GHG emissions reporting to Government will continue during the construction phase. In addition, annual construction phase GHG emissions will be reported.

7.3. Operations GHG Reporting

EACOP meets the threshold (100,000 tCO_2e/yr) in Principle 10 of EP4 requiring public reporting of annual combined Scope 1 and Scope 2 operations GHG emissions and GHG efficiency ratio. The location of the reporting, and the manner in which it is made available, is at the discretion of the Project. EACOP will present annual combined Scope 1 and Scope 2 operations GHG emissions on the EACOP website. Reporting will be in compliance with the requirements of ISO 14064 (2018, 2019) and 50001 (2018).

The following reporting principles, which are aligned with the principles outlined in IPIECA / API / IOGP GHG reporting guidelines (2011), shall be applied to GHG data collection, consolidation, and reporting for EACOP:

- Relevance.
- Completeness.
- Consistency.
- Transparency.
- Accuracy.

DEFINITIONS AND ABBREVIATIONS

ABBREVIATION	EXPLANATION
AFOLU	Agriculture, Forestry and Other Land Use
AGIs	Above Ground Installations
API	American Petroleum Institute
BAT	Best Available Techniques
BAU	Business-As-Usual
BESS	Battery Energy Storage Systems
oC	Degrees Celsius
CCKP	Climate Change Knowledge Portal
CCRA	Climate Change Risk Assessment
CCPRA	Climate Change Physical Risk Assessment
CCTRA	Climate Change Transition Risk Assessment
CFR	Carbon Footprint Reduction
CNOOC	China National Offshore Oil Corporation
CPFs	Central Processing Facilities
CO_2	Carbon dioxide
CH_4	Methane
CMIP5	Coupled Model Inter-Comparison Project, Phase 5
DRA	Drag Reducing Agent
EACOP	East African Crude Oil Pipeline
EEA	European Environment Agency
EHS	Environment, Health and Safety
EMEP	European Monitoring and Evaluation Programme
EP4	Equator Principles (4th Version)
EPA	Environmental Protection Agency
ESIA	Environment and Social Impact Assessment
FEED	Front End Engineering Design
FYDP	Five-Year Development Plan
g/kWh	Grams per kilometre
GHG	Greenhouse Gas
GWP	Global Warming Potential
HGA	Host Government Agreement
IEA	International Energy Association
IFC	International Finance Corporation

ABBREVIATION	EXPLANATION
IGA	Inter-Governmental Agreement
IOGP	International Association of Oil and Gas Producers
IPCC	Inter-Governmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
ISO	International Standards Organization
kboed	Thousand barrels of Oil Equivalent
Kg	Kilogram
$kgCO_2e/boe/km$	Kilograms of Carbon dioxide Equivalent Per Barrel of Oil Equivalent Per Kilometre
$ktCO_2e$	Thousand Tonnes of Carbon dioxide Equivalent
$ktCO_2e/yr$	Thousand Tonnes of Carbon dioxide Equivalent / Year
kWh	Kilowatt Hour
LOF	Load Out Facility
MARPOL	International Convention for the Prevention of Pollution from Ships
MCPY	Main Camp and Pipe Yard
MLBV	Mainline Block Valve
MTT	Marine Terminal and Tanks
$MtCO_2e$	Million Tonnes of Carbon dioxide Equivalent
MWp	Megawatt Peak
N_2O	Nitrous Oxide
NCCRS	National Climate Change Response Strategy
NDC	Nationally Determined Contribution
NDP	National Development Plan
NEP	National Energy Policy
OECD	Organisation for Economic Co-operation and Development
PV	Photovoltaic
OPEC	Organization of the Petroleum Exporting Countries
PRS	Pressure Reduction Stations
PS	Pumping Station
PS1	Pumping Station 1
PS2	Pumping Station 2
PS3	Pumping Station 3
PS5	Pumping Station 5
RCPs	Representative Concentration Pathways
RoW	Right of Way
TANESCO	Tanzania Electrical Supply Company

ABBREVIATION	EXPLANATION
TC	Trans-Canada
TCFD	Task Force on Climate-Related Financial Disclosures
tCO_2e/yr	Tonnes of Carbon Dioxide Equivalent Per Year
TJ	Terajoule
TIS	Thermal Insulation System
TPDC	Tanzania Petroleum Development Corporation
UNFCCC	United Nations Framework Convention on Climate Change
UNOC	Uganda National Oil Company
USA	United States of America
US	United States

ANNEX A: REFERENCES

East Africa Crude Oil Pipeline Climate Change Transition Risk Assessment (February 2022)

East Africa Crude Oil Pipeline Climate Change Risk Assessment – Physical Risk (March 2022)

EACOP Best Practices: Power Generation, Tanzania (October 2022)

European Environment Agency (EEA). 2019. EMEP (European Monitoring and Evaluation Programme) / EEA Air Pollutant Emission Inventory Guidebook (2019) Part B. Section 1.A.3.b.i-iv Road Transport (EEA Report No 13/2019) https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

International Centre for Tropical Agriculture (CIAT); BFS/USAID. 2017. Climate-Smart Agriculture in Uganda. CSA Country Profiles for Africa Series. International Center for Tropical Agriculture (CIAT); Bureau for Food Security, United States Agency for International Development (BFS/ USAID),Washington, D.C.

International Energy Agency (IEA). Emission Factors 2022. Emissions Factors 2022 - Data product - IEA

International Standards Organisation (ISO) ISO 50001:2018. Energy Management Systems (August 2018).

International Standards Organisation (ISO) ISO 14064 Greenhouse Gases (December 2018 - April 2019).

IPIECA / API / IOGP Petroleum Industry Guideline for Reporting GHG (2nd Edition 2011) Petroleum industry guidelines for reporting greenhouse gas emissions - 2nd edition | IPIECA

Ministry of Energy, Tanzania. Power System Master Plan 2020 Update. Final Report. September 2020. en-1638532283-PSMP 2020 UPDATE FINAL signed.pdf (nishati.go.tz)

Ministry of Water and Environment, Uganda. Updated Nationally Determined Contribution (NDC, September 2022) www.mwe.go.ug/sites/default/files/library/Updated NDC _Uganda.pdf)

RSK & Partner Consult Ltd. 2019. ESIA-Uganda ESIA Report – Uganda – EACOP

RSK, JSB-EnviDep Ltd & COWI Tanzania Ltd. 2019. ESIA-Tanzania ESIA Report – Tanzania – EACOP

UBOS. Uganda Bureau of Statistics. 2020. Uganda Wood Asset and Forest Resources Accounts. Uganda Natural Capital Accounting Program.

Tanzania Nationally Determined Contribution (July 2021) NATIONALLY DETERMINED CONTRIBUTIONS (NDCs) (unfccc.int)

Uganda Third National Development Plan (NDPIII) 2020/21 – 2024/25 www.npa.go.ug/wp-content/uploads/2020/08/NDPIII-Finale_Compressed.pdf

The United Republic of Tanzania: National Five Year Development Plan 2021/22 - 2025/26 FYDP III English.pdf (effectivecooperation.org)

United Republic of Tanzania. 2014. Second National Communication to the United Nations Framework Convention on Climate Change.

United Republic of Tanzania (URT) (2021). National Climate Change Response Strategy (2021-2026). Vice President's Office, Division of Environment, Government Printer, Dodoma. Tanzania nccrs_2021_2026__final_pk_1.pdf (panda.org)

United Republic of Tanzania. 2013. Vice Presidents Office. 2013. Report on Forests, Rangelands and Climate Change Adaptation in Tanzania. 2013. Presented in the Workshop on Forests, Rangelands and Climate Change Adaptationin Southern Africa, Johannesburg, South Africa 17 – 19 June 2013

United States Environmental Protection Agency (US-EPA). Protocol for Equipment Leak Emission Estimation (November 1995) Protocol for Equipment Leak Emission Estimates (epa.gov)

ANNEX B: EACOP GHG EMISSIONS CALCULATIONS

The basic method for emissions calculation is to multiply an activity data value by an emission factor.

B.1 Global Warming Potentials

Global Warming Potentials (GWP) are used to convert individual mass emissions of CH_4 and N_2O into CO_2e. For the purposes of this assessment, the GWP-100-year factors from the IPCC Fifth Assessment Report, the latest published GWP values, have been used.

$CO_2e = (1 \times CO_2) + (28 \times CH_4) + (265 \times N_2O)$ (Table B1).

Table B1 GWP Values for Gases

GASES	CO_2	CH_4	N_2O
GWP	1	28	265

B.2 Construction Phase GHG Calculation

B.2.1 Activity Data

The major construction activities are divided into categories as described in Table B2 below.

Table B2 Construction Activities Description

CATEGORY	DESCRIPTION	TYPE	EMISSION SCOPE
1	Use of Non-Road Equipment to Construct AGIs	Non-road	Scope 1
2	Use of Road Vehicles to Construct AGIs	Road	Scope 1
3	Use of Non-Road Equipment for Pipelay	Non-road	Scope 1
4	Use of Road Vehicles for Pipelay	Road	Scope 1
5	Provision of Power to Operate MCPYs & EACOP Offices	Stationary/Grid	Scope 2
6	Transportation of Workers to MCPYs & RoW	Road	Scope 1
7	Transportation of Pipe and Cable from MCPYs to the RoW	Road	Scope 1
8	Transport of Murram for Road Upgrades & New Roads	Road	Scope 1

The types of categories define the activity data that is required as an input:

Non-road (including vessels) and stationary source emissions are based on:

- Power rating (maximum power output) of the engine
- Hours of operation of the engine
- Fuel type
- Load factor (what fraction of the maximum power the equipment typically operates at, not used for vessels)
- Emission factors based on engine power and technology and expressed in g/kWh (from EEA 2019 1.A.4 for construction equipment and EEA 2019 1.A.3.d for vessels)

Road source emissions are based on:

- Distance travelled by the road-going vehicle
- Fuel type
- Emissions factors based on vehicle type and engine technology, and which are in units of grams of emitted substance per kilometre (g/km) (from EEA 2019 1.A.3.b.i-iv)

Grid emissions relate to use of the national electricity network and are based on:

- Estimated use of electricity
- Emission factors for the Ugandan and Tanzanian national power grids have been sourced from the 2022 country specific GHG emission factors for electricity and heat generation published by the IEA.

B.2.2 Emission Factors

The main source for emission factors used in the EACOP construction phase GHG qualification is the EEA Air Pollutant Emission Inventory Guidebook 2009 (EEA 2019) for the long-range transmission of air pollutants in Europe.

B.3 Operation Phase GHG Emissions

B.3.1 Activity Data

As detailed in Table 3.1, the main source of Scope 1 emissions are the back-up crude oil-fired power generation engines. Other Scope 1 sources of emissions are fugitives (leaks) from components on the system, diesel, and sea tanker venting.

These are anticipated to be minor in comparison. The only Scope 2 emissions for EACOP arise from the import of electricity from the national grid.

B.3.2 Emissions Factors

In accordance with best practice, the CO_2 emission factor has been calculated using stoichiometry calculations for the crude oil fuel compositions and averaged across the various blends. Emission factors for CH_4 and N_2O have been sourced from the IPCC guidance. Table B3 contains details of the emission factors.

Table B3 Emission Factors

EMISSION FACTORS GHG	FACTOR	UNITS	SOURCE
CO_2	3.03	Kilogram (Kg)/kg fuel	Calculated
CH_4	3.00	Kg/ Terajoule (TJ) fuel	IPCC 2019
N_2O	0.60	Kg / TJ fuel	IPCC 2019

B.3.3 Fugitive Emission Factors

The United States Environmental Protection Agency (US-EPA) has published the "Protocol for Equipment Leak Emission Estimation" guidance which includes sets of fugitive emission factors.

B.3.4 Import Electricity Grid Factor

The emission factors for the national power grid of Uganda and Tanzania have been sourced from the 2022 country specific GHG emission factors for electricity and heat generation published by the IEA.

EAST AFRICAN
CRUDE OIL
PIPELINE

EACOP PROJECT IN UGANDA

RR Pearl Tower One, Plot 1, Yusuf Lule Road,
P.O.Box 135596, Kampala, Uganda
Tel: +256 767 988 008 | 0800 216 000 (Toll Free)

EACOP PROJECT IN TANZANIA

Msasani Peninsula, Plot no. 1403, Block 1, House 7
Bains Avenue of Chole Road Wing B,
P.O. Box 23139 Dar es Salaam Tanzania
Tel: +255 222 214 100 | +255 699 022 905 | 0800 780 068 (Toll free)

Email: info@eacop.com | www.eacop.com

eacop