Eastern Africa Alliance
On Carbon Markets And
Climate Finance

STUDY ON CARBON MARKET OPPORTUNITIES AND TECHNOLOGIES FOR SEVEN EASTERN AFRICA COUNTRIES

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The views expressed in this study are those of the authors and may not necessarily reflect those of GIZ, BMWK, RCC Kampala or EAA.

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RCC East and Southern Africa
Collaboration for Climate Action

Members:

Burundi, Ethiopia, Kenya, Rwanda
Sudan,Tanzania, Uganda

Executive Summary

The main objective of this study is to assist the seven member countries of the Eastern African Alliance on Carbon Markets and Climate Finance (EAA) in considering and prioritising mitigation technologies and project activities on the path to the operationalisation of Article 6 of the Paris Agreement. The study encompasses seven countries, namely Burundi, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda. The prioritisation of mitigation technologies or activities could assist countries in developing technology "positive lists", which may be used in respective Article 6 Frameworks. Ultimately, the aim is to promote the adoption of sustainable and low-carbon technologies that can mitigate GHG emissions, support the transition to a green economy, and achieve the region's sustainable development objectives.

Priority Mitigation Technologies and Activities

Thirty-seven country-specific technologies and activities were identified through desktop reviews of available literature, namely Nationally Determined Contributions (NDCs); Technical Needs Assessments as well as relevant climate strategies, policies and plans. In addition, key country-level stakeholders were engaged through various means, including an electronic survey and virtual interviews.

The report underscores the critical importance of aligning climate measures with long-term strategies and decarbonization plans outlined in each country's NDCs. Prioritising activities and technologies that align with specific needs and objectives is crucial for effectively accessing carbon financing opportunities.

A multicriteria analysis framework was then employed to assess the identified GHG mitigation technologies and activities, considering the specific circumstances and priorities of each country. Multicriteria analysis is useful in developing informed decisions when faced with complex problems that involve multiple conflicting objectives. This is particularly relevant when considering the suitability of climate mitigation technologies and project activities, as some key benefits may appear contradictory to each other. For example, the implementation of largescale renewable energy projects may have large GHG mitigation impacts, however such projects may have limited co-benefits, compared to other project types or technologies, and may therefore face more barriers to accessing carbon finances.

Each technology, per relevant country, was assessed and scored according to nine different criteria:

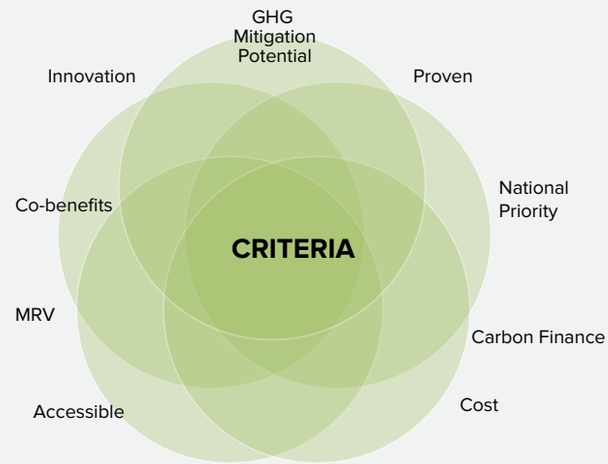

Figure 1: Criteria used in the analysis of mitigation technologies and activities

The scores, per criteria, were weighted according to different levels of priority. For example, the '*National Priority*' criterion was weighted higher than the '*Cost*' criterion.

The design of the scoring assessment reflects the objective to ensure that the 'technology-fit' with the respective countries was prioritised over the cost-effective characteristics of the identified technologies. The analyses resulted in a 'top-five list' of prioritised technologies and activities, per country, presented in the following table.

Top-five prioritised technologies and activities per country

COUNTRY	1	2	3	4	5
Burundi	Soil and water conservation	Composting	Small/micro-hydropower	Solar PV	Biogas production
Ethiopia	Industry fuel switches	Solar home systems	Landfill gas recovery and use or destruction	Sustainable forest management	E-cooking
Kenya	Biogas production	Solar home systems	Solar dryers	Afforestation and reforestation	Wind
Rwanda	Improved Cook Stoves	Small/micro-hydropower	Landfill gas recovery and use or destruction	E-cooking	Waste to energy
Sudan	Soil and water conservation	Solar PV	Composting	Smart irrigation technologies	Biogas production
Tanzania	Biofuel	Biomass to energy	Small/micro-hydropower	Sustainable charcoal production	Solar PV
Uganda	Improved livestock management	Biomass to energy	Improved Cook Stoves	Solar PV	Composting

The technologies and activities that feature in the country top-five rankings include:

- Afforestation and reforestation
- Biofuel
- Biogas production
- Biomass to energy
- Composting
- E-cooking
- Improved Cook Stoves
- Improved livestock management
- Industry fuel switches
- Landfill gas recovery and use or destruction
- Small/micro-hydropower
- Smart irrigation technologies
- Soil and water conservation
- Solar dryers
- Solar home systems
- Solar PV
- Sustainable charcoal production
- Sustainable forest management
- Waste to energy
- Wind

Most of the technologies in the top-five rankings may be considered as mature or proven technologies. The majority of the technologies are located either in the energy sector, or are technologies which result directly in carbon sequestration

Most of the technologies in the top-five rankings may be considered as mature or proven technologies. Notably, solar PV features in four countries' top-five rankings and was considered separately to solar home systems (features in two countries' top-five) and solar dryers (features in Kenya's top-five). Most of the technologies are GHG mitigation technologies, many of which are located in the energy sectors. These technologies include hydropower, wind power, biogas and biomass to energy and waste to energy. This distribution is to be expected, considering the abundant solar resources in East African, as well as the key socio-economic impacts related to the provision of clean, accessible and affordable energy.

There are four activities in the list above which result directly in carbon sequestration, namely afforestation and reforestation; improved livestock management (where this relates to improvements to the health of pastures and resulting in better soil carbon sequestration); soil conservation and sustainable forest management.

The only innovative or emerging technology in the top - five rankings is E-cooking, which features in the lists for Ethiopia and Rwanda. The three other innovative or emerging technologies considered in this assessment, namely BECCs, green hydrogen and E-mobility, did not feature in the top-five rankings. This is because they typically scored lower in the assessments relating to the accessibility, proven and cost criteria. These technologies will likely align with these criteria as they mature.

The following is a summary of the top-five technologies and activities specific to the seven East African countries in this study.

In Burundi, soil and water conservation practices were ranked highest, due to their effectiveness in mitigating GHG emissions when scaled, their potential to enhance agricultural productivity and to promote sustainable economic growth. Composting also ranked highly, due to the availability of organic feedstocks, which may ultimately provide valuable nutrients for local farming sectors, while simultaneously addressing socio and environmental issues associated with effective waste management practices. In addition, small/micro-hydropower was also ranked highly, due to its effectiveness in GHG emissions mitigation, aligned with climate change policies, which has the potential to stimulate economic growth through the provision of clean, accessible and affordable power. Solar PV technology also exhibits highly effective GHG mitigation potential due to solar resource availability, with co-benefits including job creation and support for local industries. Biogas production is considered a national priority, offering transformative changes in emissions reduction and co-benefits such as reducing methane emissions, improving waste management, and supporting local economic development.

In Ethiopia, industry fuel switches ranked highest, as they are seen as a promising solution to reducing emissions in the manufacturing sector. Notably, their scalability requires adequate support and infrastructure. Solar home systems were ranked second as they have the potential scale, especially in rural areas, where they may replace or reduce the use of non-renewable biomass and fossil fuels. Landfill gas recovery and use or destruction technologies also ranked highly because they are effective in reducing emissions and align well with waste sector priorities. Sustainable forest management practices featured as well, on account of their potential to help preserve ecosystems, create jobs, and remove GHG emissions on a long-term basis. E-cooking was included in the top-five, because the technology offers reasonable scalability with low initial costs,

promoting sustainable cooking practices in Ethiopia.

In Kenya, biogas production, using abundant agricultural and organic waste resources, is considered a promising solution for emission reduction and can create job opportunities and drive economic growth. Solar home systems can achieve modest emission reductions, with potential for large-scale implementation in off-grid communities. Solar dryers are effective in significantly reducing emissions, particularly in manufacturing industries employing drying processes. Afforestation and reforestation measures hold potential for substantial emission reductions on a large scale. Furthermore, wind technology is recognised for its significant potential in achieving substantial emission reductions, aligning with Kenya's NDC.

In Rwanda, improved cookstoves ranked highest as they are widely recognised for their effectiveness in emission reduction, offering high scalability and co-benefits of reducing biodiversity loss and air pollutants that impair health. Small/micro-hydropower also ranked highly, due to Rwanda's abundant hydro resources. It was noted that scalability from a carbon markets perspective may be limited by the relatively low grid emission factor and concerns related to negative socio and environmental impacts from hydro projects. Landfill gas recovery and use or destruction technologies also featured, as they are effective in reducing emissions. It was also noted that the scalability of such technologies may be constrained by Rwanda's small population size and low grid emission factor. E-cooking ranked in the top-five on account of the technology's innovative nature and potential for large-scale implementation. Waste-to-energy technologies also feature, as they are effective in reducing GHG emissions and contribute to national sustainable development priorities.

In Sudan, soil and water conservation ranked highest, due to alignment with national climate change policies, their ability to promote agricultural productivity, food security, and water availability. Solar PV ranked second highest, due to Sudan's abundant solar radiation and ample space for large-scale implementation. Composting also features, on account of its co-benefits that include the potential to enhance air quality and reduce pollution, contributing to a healthier environment. Smart irrigation technologies also feature in the top-five on account of their potential to conserve water, improve energy efficiency, increase crop yields, and create employment opportunities in agriculture. Biogas production was included because it is effective in reducing emissions, with co-benefits of local employment, reliable energy supply, and potential to reduce deforestation and biodiversity loss.

In Tanzania, biofuel was ranked first on account of its potential to effectively reduce emissions, using the country's abundant biomass and agricultural resources. Biomass to energy technologies followed closely for similar reasons, aligning with Tanzania's climate goals and fostering co-benefits for sustainable development. Small/micro-hydropower featured in the top-five as it offers potential for significant emission reductions and co-benefits of economic growth. Potential challenges in accessing finance were noted, on account of the potential negative socio and environmental impacts that may arise from hydropower projects. Sustainable charcoal production was included in the top-five due to its effectiveness in reducing emissions while simultaneously reducing deforestation and biodiversity loss. Solar PV was included because of Tanzania's solar resources, and the potential co-benefits related to the provision of clean and affordable electricity.

In Uganda, improved livestock management ranked highest as it has significant potential for emission reductions and aligns with Uganda's NDC. Biomass to energy technologies followed, specifically sustainable charcoal production, due to their effectiveness in reducing GHG emissions while also providing environmental co-benefits. Improved cookstoves also featured, as they offer a cost-effective approach to emission reductions and aligning with Uganda's TNA and NDC. In addition, solar PV exhibits high emission reduction potential and cost-effectiveness, aligning with Uganda's TNA and NDC. Composting, including bio latrines, was also included, due to the potential to improve air quality, health and sanitation, aligning with Uganda's TNA and NDC.

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Carbon Markets

Country level prioritisation of mitigation technologies and activities is only one component of the puzzle. Understanding the fast-evolving rules and characteristics of the current carbon markets is another key component in the system. The carbon markets were considered in the study, and broadly categorised as either Paris Agreement or voluntary markets, even though there is increasing interplay between the carbon certification standards or programmes that underpin these markets.

Particular emphasis is given in the study to cooperative approaches and mechanisms under Article 6.2 and 6.4 of the Paris Agreement, where Internationally Transferable Mitigation Outcomes (ITMOs) and Article 6.4 Emission Reductions can be respectively traded. This focus is essential to understanding the opportunities available for the Eastern African countries to participate in international carbon markets and leverage global efforts to combat climate change effectively. Additionally, the report recognises the significance of non-market approaches as outlined in Article 6.8 of the Paris Agreement, including the Adaptation Benefit Mechanism, for enhancing resilience and facilitating adaptation finance.

Conclusion and Recommendations

The prioritised technologies present opportunities for the East African countries considered in this study to combat climate change and promote sustainable development through the implementation of their long-term strategies and decarbonization plans. Effective planning and stakeholder involvement are vital for the successful adoption of these technologies. The report highlights opportunities to scale mitigation efforts and reduce associated costs by underlining the pivotal role of these technologies in achieving a sustainable and low-carbon future. Strategic implementation of these technologies through carbon credit projects holds the potential to significantly impact global efforts to combat climate change.

The identified priority areas and technologies may offer investment and collaboration opportunities, fostering emission reduction goals while bolstering economic growth and livelihoods in the region. The study delivers crucial insights into prioritising GHG mitigation technologies and activities for Eastern African countries, while pinpointing opportunities for accessing carbon markets. These findings, however, are not intended to be conclusive in themselves. Rather, they are meant to serve as guides for further, comprehensive investigations by the respective countries. Adoption of sustainable and low-carbon technologies will drive emission reduction targets and sustainable development objectives in the region, as these proactive measures pave the way for informed decision - making and strategic planning.

The report recommends that this study may be used as the basis for further, detailed investigations into the viability of the prioritised technologies, at country-level. Furthermore, the report recommends exploring avenues for collaboration and knowledge sharing among the East African countries, monitoring and evaluating technology progress, considering Article 6 ‘positive lists’, proposing simplified approaches for demonstrating additionality, development of standardized baselines and evaluating the impacts of tax incentives on technologies and project activities. These proactive measures may propel the region’s transition to a green economy, ultimately achieving sustainable development objectives.

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