



Adoption of Agrisolar Technologies in East Africa: Case of Policy Landscape in Kenya, Uganda and Tanzania



Prepared by Kenya Climate Innovation Center | DREEM Program

August 2025

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ACKNOWLEDGEMENTS

KCIC acknowledges the support of the Mott Foundation in funding this work under the Distributed Renewable Energy Ecosystem Model (DREEM) programme.

The development of this paper was co-ordinated by KCIC, with contributions from Joseph Murabula, Vincent Ogaya, Saumu Ismail and Faith Chelangat.

KCIC acknowledges the technical support provided by Brics Insights Consulting, through Bright Masakha Wekesa and Austin Cheboi, in preparing the paper.

We also thank stakeholders who participated in the Cross-Learning Policy Webinar on Agri-Solar Adoption in East Africa on 7 July 2025 and the DREEM Partners Conference on 9th to 10th July 2025. Their contributions informed the findings and recommendations presented in this paper.

EXECUTIVE SUMMARY

Agri-solar technology is a game changer for the smallholder farmers transformation and rural livelihood. Within the East Africa region that experiences climate variability, food shortage and pockets of hunger, Agri-solar technology presents potential solutions to drought resilient irrigation and post-harvest losses-transforming food security landscape. Agri-solar technology could reduce the dependency on costly and unreliable diesel-powered fossils while expanding energy access to underserved areas. However, the adoption of this technology remains low due to several persistent factors. High upfront costs, inadequate financial capacity, shortage of technicians, weak policy support, and unclear regulatory frameworks continue to deter both private sector investment and smallholder uptake, remaining key barriers to the adoption of Agri-solar technologies. Also, fragmented coordination among stakeholders, poor market linkages and farmers risk on theft and poor quality of products further hinder uptake. Fragmented coordination among the stakeholders, inadequate market linkages coupled with equipment theft and poor-quality products further complicate the scale up of Agri-solar solutions.

Despite these challenges, there has been significant progress through innovative financing, pilot projects and demonstration platforms. Yet, these efforts are insufficient to unlock the full potential of Agri-solar solutions for sustainable agricultural transformation in the region. Absence of clear and targeted policy frameworks continues to create uncertainty among the investors. Private sector investments are prone to perception of high risks due to limited subsidies and inconsistent regulations, while farmers struggle with affordability and inadequate technical capacity. Further, lack of harmonized standards across the region coupled with fragmented regional frameworks and weak institutional coordination have further obstructed the implementation and adoption of Agri-solar technology.

With the potential of Agri-solar transforming pathway for agricultural resilience in East Africa, there is need to scale up its adoption. Governments in Kenya, Uganda and Tanzania should harmonize energy, agriculture and water policies to create integrated framework that supports widespread adoption of Agri-solar technologies. Additionally, development partners, financial institutions and government can enhance inclusive financing through simple and standard blended models complemented with leasing in the region. Also, collaborating with vocational institutions to support rural technical capacity. Regional bodies like EAC should standardize equipment service certifications for technicians in the region while supporting cross-border labor mobility and trade through coordinated tests and certification programs. Consequently, a phased road map, multi-stakeholder coordination and robust monitoring framework is crucial for mainstreaming Agri-solar into national plans.

ACRONYMS

AfDB	African Development Bank
COMESA	Common Market for Eastern and Southern Africa
DREEM	Distributed Renewable Energy Ecosystem Model
EAC	East African Community
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für International Zusammenarbeit
KALRO	Kenya Agricultural and Livestock Research Organization
KCIC	Kenya Climate Innovation Center
NGOs	Non-Governmental Organizations
PUSE	Productive Use of Solar Energy
UN-SDG	United Nation Sustainable Development Goals
UNDP	United Nation Development Program
WWF	World-Wide Fund
PAYGO	Pay As You Go
EPRA	Energy Petroleum Regulatory Authority
REREC	Rural Electrification and Renewable Energy Corporation
REA	Rural Electrification Authority
AFOLU	Agriculture, Forestry, and Other Land Use
NDC	Nationally Determined Contribution
ECLOF	Ecumenical Church Loan Fund-Kenya
NAVCDP	National Agricultural Value Chain Development Project
NCCAP	National Climate Change Action Plan (NCCAP)
MW	Mega Watts
EAC	East African Community
EAPP	Eastern Africa Power Pool (EAPP),
IDA	International Development Association
VAT	Value Added Tax

PPP	Public-Private Partnership (PPP)
UECCC	Uganda Energy Credit Capitalization Company
MRE	Monitoring Reporting and Evaluation
REFIT	Renewable Energy Feed-in Tariffs

1. INTRODUCTION

1.1 Background

The East African Community region that is, Kenya, Uganda, and Tanzania, is frequently affected by food shortages and pockets of hunger due to a complex mix of factors, including high weather variability caused by climate change and the absence of good governance. Agriculture remains the primary livelihood source for most of the population; the sector contributes over 30 percent of GDP and employs 60–70 percent of the working population, yet it is highly vulnerable to climatic changes and low mechanization due to power deficits¹. These climate-related shocks undermine crop yields and food security. Inadequate and unreliable energy access constrains agricultural productivity, limiting farmers' ability to irrigate crops and store food safely, hence increasing post-harvest losses, which range from 30% in cereals, 50% in roots and tubers, and up to 70% in fruits and vegetables². While large populations live in rural areas (Tanzania 26% urban & 74% rural; Kenya 22% urban & 78% rural and Uganda 13% urban and 87% rural)³, with manual labor and diesel-powered systems remain largely in use, neither of which are sustainable nor scalable within the larger decarbonization commitments. This overlap of weak energy infrastructure, poor climate-sensing capacity, and agricultural dependency highlights the urgent need for solar energy solutions.

The adoption of Agri-solar technology in East Africa is a critical imperative to catalyze the region's energy transition that would enhance energy access, sustainability, and climate resilience⁴. The productive use of solar energy to power agricultural activities is critically important in the region facing challenges of food security, energy access and climate change⁵. Nearly 20 million people (approximately 10%) are experiencing food insecurity⁶, and the region continues to face a discouraging trend in nutrition indicators. In addition, water access has remained a crucial factor in advancing livelihood in the region. The strategies aimed at reducing chronic hunger and enhancing livelihoods have encountered limitations due to climate change and ecological vulnerabilities. Historically, powering agricultural production has been a challenge with the majority of farmers relying on unsophisticated methods for implementation⁷. Severe electricity shortages in the region as result of the deficit power generation and low grid connectivity are barriers to affordable and sufficient energy access for the impoverished population⁸. Much of this energy access progress can be achieved in a regional landscape that supports the productive use of energy sources at scale.

¹ Mukasa, A. N., Woldemichael, A. D., Salami, A. O., & Simpasa, A. M. (2017). Africa's agricultural transformation: Identifying priority areas and overcoming challenges. *Africa Economic Brief*, 8(3), 1-16

² <https://www.eac.int/press-releases/141-agriculture-food-security/2393-eac-records-huge-post-harvest-losses-in-cereals-and-root-crops>

³ East Africa Community (2016), Vision 2050; Regional Vision for Socio-Economic Transformation and Development; https://www.foreign.go.tz/uploads/eac_vision_2050-_web.pdf

⁴ Maity, R., Sudhakar, K., & Razak, A. A. (2024). Agri-solar water pumping design, energy, and environmental analysis: A comprehensive study in tropical humid climate. *Heliyon*, 10(21).

⁵ Mulyanyuma, A. A. (2024). Assessing the Impact of Climate Change on Energy Security in East Africa: Challenges and Opportunities. *Covenant University Journal of Politics and International Affairs*.

⁶ KIBATI, M. V. (2024). *The state of the agricultural development and food security in the East African Community*.

⁷ Historically, powering agricultural production has been a challenge with majority of farmers relying on manual labor with unsophisticated implements

⁸ Batinge, B., Musango, J. K., & Brent, A. C. (2019). Perpetuating energy poverty: Assessing roadmaps for universal energy access in unmet African electricity markets. *Energy Research & Social Science*, 55, 1-13.

In enhancing the successful adoption of Agri solar technologies in the region, this policy paper examines the policy landscape in the region, institutional, financial and technical aspects of Agri-solar uptake in Kenya, Uganda and Tanzania while presenting the opportunities and actionable recommendations for accelerating the adoption of Agri-solar technologies in the region. Specifically, the paper focuses on;

- i. Reviewing the relevant literature to understand the existing policy instruments affecting Agri-solar adoption
- ii. Addressing the capacities needed to foster cross-country learning among stakeholders
- iii. Identifying policy gaps and opportunities for improved policy coherence
- iv. Identifying and recommending actionable areas for future collaboration and interventions.

The paper is structured as follows. Section 2 articulates the overview of Agri-solar adoption in the specific EAC member states, the existing policies and institutional frameworks, challenges limiting Agri-solar adoption, section 3 provides policy gaps and challenges while section 4 offers recommendations on the policy position. Finally, section 5 of the paper presents implementation considerations to enhance the adoption of Agri-solar technology in Kenya, Uganda and Tanzania.

2. AGRI-SOLAR TECHNOLOGY ADOPTION IN THE EAC REGION

2.1 Overview of Agri-solar adoption in the EAC Region (Kenya, Uganda and Tanzania)

This section provides an overview of the Agri-solar adoption landscape in the East African Community, focusing on Kenya, Uganda, and Tanzania. Across these countries, solar technologies are increasingly being integrated into agriculture for irrigation, post-harvest handling, and value addition, signaling a regional transition toward clean energy solutions that boost productivity, reduce losses, and promote climate-resilient food systems.

2.1.0 Agri-solar adoption in Kenya

Kenya has made significant strides in promoting agri-solar technologies, particularly across dairy and horticulture value chains. At the national scale, the Kenya Off Grid Solar Access Project (KOSAP) has been transformative. Since its inception in 2017, with US\$150 million in World Bank financing, KOSAP has installed 137 solar mini grids across 14 underserved counties. These systems have electrified 567 public facilities, including schools and health centers, powered 380 boreholes, and extended electricity access to some 277,000 households (about 1.5 million “people”⁹). Kenya Climate Innovation Center (KCIC), alongside private firms such as SunCulture, Futurepump, and Davis & Shirliff, have introduced “pay-as-you-go, leasing, and ownership financing models that reduce barriers for smallholder farmers adopting solar irrigation and drying” systems. The Kenya Climate Innovation Center (KCIC), through its DREEM project, is actively working to provide off-grid solutions to off-grid populations, particularly in Kenya's arid and semi-arid (ASAL) regions. This initiative

⁹ Ministry of Energy and Petroleum (2024), Renewable Energy Project & Studies; <https://www.energy.go.ke/renewable-energy-projects>

focuses¹⁰ project, a Mott Foundation funded project, employs a hub-and-spoke model, with KCIC acting as the central hub and various partners providing support services. Other institutions like Safaricom further support the sector by enabling payments and credit ratings to be scored through platforms such as M-Pesa. However, private actors struggle with small and price-sensitive markets, counterfeit products, and a shortage of skilled technicians.

For the devolved units, counties like Laikipia solar drying technology is increasingly deployed, supported by improved financial access for cooperatives and farmers. The county also uses solar energy for electric fencing to protect farms, although over 30% of its land remains underutilized, with 70% of economic activities revolving around dairy farming¹¹. Makueni County has gone further, integrating solar energy into water pumping, cold-chain infrastructure, and agribusiness facilities, including a 205 kW solar plant powering the Makueni County Referral Hospital and solar energy supporting the county's fruit processing plant. It also hosts Kenya's first agrivoltaics pilot in Ngomano, where solar panels generate electricity while shading crops, enhancing water retention, drip irrigation efficiency, and post-harvest yields for over 250 households.

The Makueni County Government has embedded these efforts into its green energy strategy. In 2023, it unveiled a KSh 74 billion (US\$ 550 million) Energy Plan developed in partnership with the UK government, Strathmore, and the World Resources Institute¹². The plan aims for universal electrification by 2026 and clean cooking by 2028, while prioritizing solar-powered irrigation schemes (such as Kikome, Kathambalani, and Mbavani) and agrivoltaics greenhouses at Ngomano. Additional partnerships with the Climate Innovation and NAVCDP programs have introduced farmer-led irrigation pond systems to irrigate over 500 ha using solar-powered pumps and climate-resilient water harvesting, while training more than 156,000 farmers across key value chains to scale sustainable agriculture.

There are, however, challenges around affordability, servicing and customer care lapses. With these innovations, service providers ought to reach even low-income farmers, who constitute the majority of the agricultural sector. Therefore, addressing the key barrier of upfront cost and transforming the irrigation sector with flexible payments.

2.1.1 Agri-solar adoption in Uganda

Uganda is rapidly expanding Agri-solar use in dairy value chains and small-scale irrigation through public-private collaboration and subsidy schemes. Key projects include; Heifer International's, supported by the PREO (Powering Renewable Energy Opportunities) program¹³, has rolled out solar-powered milk chilling systems across multiple dairy cooperatives, including installations at Dwaniro and Nabitanga cooperatives in Kiboga and Ssembabule districts. A 41 kWp PV system at Migina Milk Collection Centre alone now chills over 197,000 litres of milk monthly, cutting diesel generator fuel costs by more than half and eradicating spoilage losses. Further, strategic initiatives such as Heifer's Distributed Renewable Energy Ecosystem Model (DREEM) Hub and Green Dairy

¹⁰ <https://www.kenyacic.org/dreem/>

¹¹ Laikipia County (2022), Improving Livelihoods through Agribusiness; weekly bulletin issue no.0107 July 10-17,2022

¹² <https://makueni.go.ke/2024/news/makueni-unveils-costed-10-year-green-energy-plan/>

¹³

<https://www.preo.org/news/project-news/sustainable-dairy-development-lessons-from-heifer-internationals-project-to-solarise-ugandan-milk-chilling-centres/>

Projects further bolster Agri-solar uptake by empowering farmers, youth, and women entrepreneurs with business support and clean-energy infrastructure across central and southwestern Uganda¹⁴.

The Government of Uganda, via the Ministry of Water and Environment and in partnership with Nexus Green and donors, is executing a solar-powered water irrigation scheme targeting over 400 off-grid irrigation sites across northern and eastern Uganda. These sites serve smallholder clusters—enabling up to four cropping seasons annually and benefiting an estimated 3,000 farmers and 2.6 million rural and urban residents with irrigation and clean water access¹⁵. Meanwhile, subsidy-based solar pump programs under the Global Green Growth Institute (GGGI) and World Bank-backed PUSE (Productive Use of Solar Energy) roadmap support farmers financially and technically though uptake remains low in some refugee-hosting regions due to high cost-sharing thresholds (typically 25%) and disconnected coordination between ministries¹⁶. ACODE (Advocates Coalition for Development and Environment), in partnership with Heifer and under the DREEM initiative, is actively advocating for improved PUSE integration into climate-smart agriculture strategies and affordable solar access in rural districts.

Despite impactful progress, Uganda's Agri-solar sector faces persistent hurdles: fragmented subsidy administration, poor enforcement of quality standards, insufficient farmer awareness, limited financing options and technical service support, especially in remote areas. Misalignment of public-sector plans such as irrigation master plans, and inconsistent coordination across ministries further slow scaling from pilots to national adoption. Strengthening harmonization of PUSE strategies, enabling private-sector-led financing and enforcing quality assurance protocols will be critical to unlocking Agri-solar's full potential across Uganda's agriculture.

2.1.2 Agri-solar adoption in Tanzania

Tanzania is gradually embracing Agri-solar across fisheries, irrigation, and post-harvest processing, particularly in under-served regions with limited grid access. In island fisheries such as Mafia, solar lanterns and drying technologies have replaced diesel-based systems, modernizing *dagaa mafia* fishing and enabling traders to command higher prices in cross-border markets including Congo. In agriculture, solar-powered pumps are being deployed for irrigation, cooling, and drying, in part via hybrid systems combining solar and biomass to boost efficiency. Though only about 2–2.5% of arable land is currently irrigated by any means, solar irrigation holds potential to dramatically expand this footprint, especially in value chains like horticulture and dairy¹⁷.

Leading the charge are actors such as WWF, which promotes Agri solar as part of climate-smart agriculture, and private companies backed by Power Africa, including SimuSolar, which has introduced pay-as-you-go solar irrigation pumps and fishing lights across Tanzania to improve farmer livelihoods and reduce operational costs¹⁸. In Iringa and Mufindi districts, significant installations such as the Kibidula solar-powered irrigation plant (68 kW, pumping 1.5 million liters/day)

¹⁴

<https://www.monitor.co.ug/uganda/news/national/experts-push-for-increased-solar-funding-to-power-agricultural-growth-5036824>

¹⁵

<https://www.monitor.co.ug/uganda/business/markets/govt-plans-to-construct-687-solar-irrigation-sites-4121768>

¹⁶ <https://gggi.org/project/ug23-promoting-solar-powered-irrigation-and-pumping-in-uganda/>

¹⁷ [Increasing the use of solar powered pumps for Irrigation in Tanzania](#)

¹⁸

<https://powerafrica.medium.com/power-africa-supports-tanzania-based-solar-company-to-fuel-livelihoods-of-rural-farmers-and-fishers-1d23eceaebd>

demonstrate the feasibility of commercial-scale systems for crops like avocados, driven by solar modules and surface pumps¹⁹. Development NGOs like ELICO Foundation (supported by Mott Foundation) are piloting mobile, small-scale solar pumps (0.5–2 hp) coupled with PAYGO financing, irrigation-as-a-service models, and agribusiness minigrids- to reach remote smallholders²⁰.

Despite these successes, the Agri solar market in Tanzania remains nascent with **penetration among smallholder farmers at** roughly 1%, mirroring broader sub-Saharan averages²¹. Key constraints include high upfront costs, fragmented subsidy schemes, unreliable after-sales service, and scarcity of technical skills in rural areas. Regulatory advancements have begun: TAREA, in partnership with the Netherlands' Energy Transition Facility, is working with Tanzania Bureau of Standards to develop minimum performance requirements for solar irrigation pumps, a step toward curbing counterfeit products and improving quality control²². Strengthening institutional coordination, financing models, and technician training will be essential to scale Agri solar adoption and realize its potential for sustainable agriculture in Tanzania.

2.2 The EAC national policies, strategies, legal and regulatory frameworks that govern Agri-Solar landscape

2.2.1 Kenya

Kenya has established a comprehensive policy, legal, and regulatory framework that supports renewable energy integration and the productive use of solar technologies in agriculture. The **Kenya National Energy Policy (2018)** and **Kenya National Electrification Strategy (2018)** set the foundation for expanding access to clean energy, emphasizing decentralized solar solutions and encouraging private-sector investment in off-grid and mini-grid systems. Complementing these are the **National Energy Efficiency and Conservation Strategy (NEECS) 2020**, which promotes energy-saving technologies in agriculture, and the **National Climate Change Action Plan (NCCAP 2023-2027)**, which prioritizes climate-smart solutions, including solar-powered irrigation and mechanization, as key adaptation measures.

Kenya has introduced several regulatory instruments designed to ensure quality assurance, consumer protection, and operational compliance for solar energy systems, which are essential for promoting Agri solar adoption. The **Energy (Appliances Energy Performance and Labelling) Regulations, 2016** establish minimum energy performance standards and labelling requirements for appliances, including solar components, to enhance efficiency and safeguard consumers from substandard products. The **Draft Energy (Solar Photovoltaic Systems) Regulations, first introduced in 2012 and revised in 2020**, provide detailed guidelines on licensing, installation, inspection, and certification of solar PV systems and technicians. This ensures the reliability and safety of solar solutions used in agricultural applications such as irrigation and cold storage but requires sufficient public awareness for proper implementation especially at the community level. Similarly, the **Draft Energy (Mini-grid) Regulations, 2022** streamline the licensing and tariff approval processes for mini-grid projects, fostering private-sector participation in rural electrification.

¹⁹ AGRF: Tanzania dramatically increases its irrigation budget to stay as the top regional food exporter

²⁰ Revolutionizing Agriculture in Rural Tanzania with Solar-Powered Irrigation Systems

²¹ Durga, N., Schmitter, P., Ringler, C., Mishra, S., Magombeyi, M. S., Ofosu, A., ... & Matambo, C. (2024). Barriers to the uptake of solar-powered irrigation by smallholder farmers in sub-saharan Africa: A review. *Energy Strategy Reviews*, 51, 101294.

²² Increasing the use of solar powered pumps for Irrigation in Tanzania.

These mini-grids are crucial for powering irrigation systems and agro-processing in off-grid farming communities. The **Draft Energy (Solar Water Heating) Regulations, 2024** aim to standardize and mandate the installation of solar water heating systems in institutions and industries, creating opportunities for integration in agro-processing sectors that require thermal energy, such as dairy and horticulture. Finally, the **Draft Energy (Renewable Energy Resources) Regulations, 2025** provide an overarching framework for developing, licensing, and monitoring renewable energy resources, including solar. These regulations seek to streamline investment processes, enhance compliance, and encourage innovative solutions such as hybrid systems combining solar with other renewables for agricultural use. Collectively, these regulatory measures demonstrate Kenya's commitment to accelerating clean energy adoption across sectors, including agriculture. By setting clear technical standards, improving consumer confidence, and creating a predictable investment environment, these instruments play a vital role in scaling Agri solar technologies and supporting climate-smart agriculture.

On the agricultural side, policies and legislation explicitly link renewable energy to agricultural modernization. The **National Agricultural Mechanisation Policy (2021)** promotes integration of clean energy technologies for mechanization and value addition, while the **Irrigation Act No. 14 of 2019** provides a legal basis for irrigation development through modern technologies, including solar-powered pumping. The **National Irrigation Sector Investment Plan (NISIP) 2025** operationalizes this by prioritizing locally adapted irrigation systems powered by solar, with cost estimates ranging from USD 5,000 to USD 12,000 per hectare based on groundwater development needs. Together, these frameworks align energy and agricultural strategies to boost productivity and climate resilience.

To incentivize uptake, Kenya has implemented **VAT exemptions for solar equipment**. VAT exemptions were initially introduced in 2014 under paragraph 48 of the first schedule of the VAT Act, 2013. Although a 14% VAT rate was adopted in the 2020 Finance Act, the exemptions were later reinstated in the Finance Act of 2021²³, reflecting fluctuating policy approach over the years causing market uncertainty. Despite a broadly supportive policy landscape, barriers such as high upfront costs, limited access to finance, inadequate technical capacity, and overlapping institutional mandates remain key challenges. Coordinated implementation of these instruments, alongside targeted financial incentives and capacity-building efforts, will be critical to accelerating Agri solar adoption across Kenya's agricultural value chains

2.2.2 Uganda

Uganda's policy and regulatory framework for Agri solar adoption is anchored in a series of instruments that promote renewable energy and sustainable agricultural development. The **Renewable Energy Policy (2007)** and the **Energy Policy for Uganda (2002)** laid the foundation for diversifying the country's energy mix, explicitly prioritizing solar as a key technology for off-grid electrification and productive uses in agriculture. The forthcoming **National Energy Policy (draft 2019 update)** builds on this by strengthening commitments to renewable energy and setting targets for solar deployment in rural areas, where agriculture is the main economic activity.

²³ Kenya Law (2021), Kenya Gazette Supplement No. 86 (National Assembly Bills No. 18), The Finance Bill Act of 2021

Climate-smart agriculture and resilience building are guided by the **National Climate Change Policy (2015)**, which recognizes renewable energy as an adaptation measure, and supported by the **Climate Change Act (2021)**. In the agricultural domain, the **National Agriculture Policy (2013)** and the **Agriculture Sector Strategic Plan (ASSP) 2020–2025** emphasize the integration of sustainable energy solutions into mechanization and irrigation to improve productivity and reduce vulnerability to climate variability. The **Irrigation Policy (2018)** complements these objectives by promoting affordable, efficient irrigation systems powered by renewable energy technologies, including solar pumping solutions for smallholder farmers.

While this policy framework demonstrates strong intent, implementation remains a major challenge. Weak institutional coordination at the district level, fragmented subsidy programs, and inadequate enforcement of quality standards limit the effectiveness of these policies. In addition, inconsistent tariff and tax measures, such as import duties on critical solar components, have raised system costs, making Agri solar technologies less affordable for smallholders. Addressing these challenges will require harmonized implementation, stronger regulatory enforcement, and financial incentives tailored to small-scale farmers to accelerate Agri solar adoption across Uganda’s agricultural value chains.

2.2.3 Tanzania

Tanzania has established a policy framework that prioritizes renewable energy development and its application in agriculture, reflecting the government’s commitment to sustainable and climate-resilient growth. The **National Energy Policy (2015)** serves as the cornerstone for promoting renewable energy, including solar, as a key driver for rural electrification and productive use in sectors such as irrigation and Agro-processing. Complementing this, the **Five-Year Development Plan III (FYDP III, 2021–2026)** underscores the role of energy in achieving economic transformation, with renewable energy explicitly positioned as a catalyst for agricultural modernization.

In the agricultural domain, the **National Agriculture Policy (2013)** and **National Irrigation Policy (2010)** promote the adoption of modern technologies, including solar-powered irrigation systems, to enhance water use efficiency and increase agricultural productivity. These policies recognize the importance of affordable and decentralized energy solutions for smallholder farmers, who form the backbone of the agricultural sector. Climate resilience objectives are supported by the **National Climate Change Strategy (2012)**, which advocates for renewable energy as an adaptation measure to reduce vulnerability to climate shocks.

The regulatory framework further strengthens investment in renewable energy through the **Renewable Energy Feed-in Tariff Framework (Small Power Producers Framework, 2015)**, which enables small-scale power producers to sell excess energy to the national grid. This creates opportunities for farmer cooperatives and agribusinesses to generate additional income streams by connecting solar-powered mini-grids or productive-use systems to the grid.

Despite these enabling policies, Agri solar adoption in Tanzania faces significant barriers. Multi-agency licensing requirements and overlapping institutional mandates create bureaucratic delays, while limited rural financing mechanisms and inadequate technical capacity constrain scalability. High upfront costs for solar technologies further restrict access for smallholder farmers,

who represent the largest potential market segment. Addressing these challenges will require harmonized policy implementation, expanded financial incentives, and targeted capacity-building initiatives to unlock the full potential of Agri solar in Tanzania's agricultural value chains.

2.2.4 Regional Frameworks

At the regional level, the **East African Community (EAC) Energy Policy (2018)** provides a foundation for harmonizing renewable energy standards, promoting cross-border energy trade, and integrating solar solutions into agricultural development. Regional frameworks such as the **EAC Climate Change Policy (2011)**, **Climate Change Master Plan**, and **EAC Vision 2050** advocate for climate-smart agriculture and renewable energy adoption, directly supporting solar-powered irrigation and productive-use technologies. Initiatives like the **Eastern Africa Power Pool (EAPP)** facilitate cross-border electricity exchange, which could benefit farmer cooperatives generating excess solar energy.

Additionally, COMESA's **Energy Policy Framework (2015)** complements EAC efforts by promoting technical harmonization, capacity building, and investment in renewable energy, including Agri solar solutions. Despite these provisions, practical challenges such as inconsistent national regulations, complex licensing, lack of harmonized grid codes, and high investment costs hinder effective implementation. Youth-specific barriers and fragmented institutional roles further limit uptake. Harmonization of standards under the EAC renewable energy initiatives and solar product certification remains a priority for creating an integrated market for Agri solar technologies in the region.

Overall, Kenya, Uganda, and Tanzania have established broadly supportive policy and regulatory environments for Agri solar adoption, with varying levels of maturity and alignment across energy, agriculture, and climate sectors. Kenya demonstrates strong policy readiness through an extensive framework of energy, irrigation, and mechanization policies, supported by detailed draft regulations and investment plans such as the National Irrigation Sector Investment Plan (NISIP) 2025. Uganda's policy foundation, anchored in the Renewable Energy Policy (2007) and complemented by agriculture and climate strategies, provides a clear vision for integrating solar into farming systems, although implementation gaps and inconsistent fiscal incentives remain key challenges. Tanzania's policy landscape, guided by the National Energy Policy (2015), agriculture and irrigation policies, and the Renewable Energy Feed-in Tariff Framework, positions renewable energy as central to development objectives but faces persistent institutional coordination and financing constraints. While all three countries recognize Agri solar as an enabler for climate-smart agriculture, achieving large-scale adoption will require harmonized implementation, stronger incentive structures, and improved technical and financial capacity at both national and subnational levels.

3.0 POLICY GAPS AND CHALLENGES WITH RECOMMENDATIONS

Despite notable policy progress across Kenya, Uganda, and Tanzania, significant gaps hinder large-scale Agri solar adoption. None of the three countries' policies explicitly prioritize Agri solar, creating uncertainty for investors and limiting programmatic alignment between energy, agriculture, and climate strategies. Incentive structures remain weak and inconsistent, discouraging private-sector participation, while high upfront costs and limited credit access continue to constrain affordability for smallholder farmers. Furthermore, inadequate technical capacity and low awareness at both farmer and institutional levels hinder sustainability, while fragmented regional standards and cross-border regulatory inconsistencies raise operational costs and reduce market integration. Addressing these challenges will require harmonized policy implementation, stable incentive frameworks, innovative financing mechanisms, and coordinated capacity-building initiatives to fully unlock Agri solar's transformative potential for East Africa's agricultural sector. The following sections offer specific country level policy gaps, and challenges coupled with recommendations.

3.1 Policy and Regulatory Inconsistencies

Kenya: While Kenya has advanced renewable energy policies, they do not explicitly prioritize Agri solar solutions such as solar-powered irrigation and agro-food processing, creating uncertainty for investors. Weak coordination between national ministries and county governments often leads to fragmented support and duplication of efforts. Inadequate budget allocations and limited technical capacity at the county level further constrain the integration of Agri solar into agricultural programs.

Recommendations:

- Explicitly integrate Agri solar in energy, irrigation, and mechanization policies.
- Establish inter-ministerial and national–county coordination frameworks for joint implementation.
- Allocate dedicated budgets for Agri solar programs within county development plans.

Uganda: The Renewable Energy Policy (2007) and Energy Policy (2002) broadly promote renewable energy but lack specific provisions for Agri solar technologies, leaving a policy vacuum for solar-powered productive use in agriculture. Weak enforcement mechanisms and poor coordination across ministries hinder effective implementation, especially at district level.

Recommendations:

- Update energy and agriculture policies to recognize Agri solar as a priority.
- Strengthen enforcement of renewable energy guidelines through regulatory bodies.
- Develop district-level coordination structures to integrate Agri solar initiatives.

Tanzania: Despite progressive energy and agriculture policies, Tanzania does not explicitly target Agri solar systems that combine renewable energy with agricultural production. Multi-agency overlaps and insufficient coordination at local levels have limited harmonized programs that could integrate renewable energy into sustainable agriculture initiatives.

Recommendations:

- Revise the National Agriculture and Irrigation Policies to include Agri solar systems.
- Establish a single-window licensing system to reduce bureaucratic overlaps.
- Enhance institutional capacity for coordination between energy and agriculture agencies.

3.2 Weak Incentives for Private Sector Investment

Kenya: While VAT exemptions for solar equipment exist, they have been inconsistent over time, creating uncertainty for investors. Lack of targeted subsidies or risk-sharing mechanisms discourages private companies from investing in Agri solar for smallholder markets perceived as high-risk and low-return.

Recommendations:

- Maintain consistent incentives programs to support the development of local manufacturing trade of the solar equipment including VAT exemptions for Agri solar equipment.
- Create risk-sharing facilities or guarantee funds for private investors.
- Launch national incentive programs to scale solar irrigation and agro-processing solutions, a market pull factor that incentivise scaled solar equipment production and sale.

Uganda: Limited fiscal incentives and weak policy clarity on Agri solar undermine investor confidence. The absence of large-scale national programs targeting solar irrigation leaves the market to fragmented private initiatives with minimal government backing.

Recommendations:

- Introduce tax exemptions and subsidy schemes for Agri solar equipment.
- Develop a national Agri solar program linked to irrigation development initiatives.
- Promote blended financing and PPPs to attract private-sector engagement.

Tanzania: No comprehensive incentive structure exists for Agri solar technologies, and subsidies for solar-powered irrigation systems are lacking. Inconsistent regulatory frameworks and perceived market risks further deter long-term commercial investments.

Recommendations:

- Reinstate and expand fiscal incentives such as VAT exemptions for solar systems.
- Establish concessional financing schemes and grants for Agri solar businesses.
- Promote PPPs and integrate Agri solar into rural electrification strategies.

3.3 Financing Barriers for Farmers

Kenya: Smallholders face high upfront costs for solar irrigation systems, compounded by expensive installation and maintenance services. While credit products exist, they are largely unaffordable due to high interest rates and collateral requirements.

Recommendations:

- Expand micro-credit and PAYGO models for Agri solar technologies.
- Reduce collateral requirements through guaranteed schemes.

- Integrate Agri solar into agricultural credit lines managed by commercial banks and MFIs.

Uganda: Farmers struggle with similar cost barriers, and available credit schemes are limited in reach and costly. Financial institutions classify Agri solar as high-risk, reducing access to affordable loans for small-scale farmers.

Recommendations:

- Promote affordable microfinance and SACCO-based lending models for Agri solar.
- Encourage partnerships between banks and development partners for blended finance solutions.
- Design crop-linked repayment schemes tied to agricultural seasons.

Tanzania: Financing options for farmers are minimal, with no dedicated national subsidy program for solar irrigation. Limited engagement by microfinance institutions and a lack of innovative models like PAYGO make affordability a critical barrier.

Recommendations:

- Establish dedicated credit facilities and subsidies for solar irrigation under rural energy funds.
- Promote PAYGO and leasing models to spread costs over time.
- Develop government-backed low-interest loan products for Agri solar adoption.

3.4 Limited Technical Capacity and Awareness

Kenya: Shortage of certified technicians and limited farmer training programs lead to poor system maintenance and breakdowns, increasing costs for farmers.

Recommendations:

- Develop certification programs for solar technicians in collaboration with TVET institutions.
- Expand farmer training on Agri solar operation and maintenance through extension services.
- Promote private sector-led awareness campaigns on Agri solar benefits.

Uganda: Low levels of farmer awareness on Agri solar benefits and absence of structured capacity-building programs constrain adoption. Additionally, gaps in technical expertise create maintenance challenges.

Recommendations:

- Integrate Agri solar modules into agricultural extension programs.
- Build technical training centers for renewable energy technicians.
- Foster demonstration projects at district level to enhance farmer awareness.

Tanzania: Technical capacity for installation and after-sales service is inadequate, especially in rural areas. Lack of awareness campaigns and innovative financial products like micro-leasing limits market penetration.

Recommendations:

- Partner with private firms to train local technicians on solar systems.
- Introduce government-supported awareness programs targeting smallholders.
- Encourage financial institutions to develop tailored products for agrisolar adoption.

3.5 Recommendation on cross-border coordination mechanisms

Regional Issue (EAC): All three countries face barriers due to fragmented technical standards, inconsistent certification, and lack of harmonized quality control mechanisms. This increases operational costs for businesses and complicates cross-border trade in solar equipment. Limited recognition of technician certifications across borders also restricts labor mobility, creating workforce shortages in some markets. Weak institutional coordination and delays in implementing harmonized EAC energy regulations further slow regional market integration for Agri solar products.

A central monitoring and evaluation framework should track progress, promote accountability and guide adaptive policy improvement across all coordination levels. Monitoring Reporting and Evaluation (MRE) should be developed in both national and local levels, defining policy goals including adoption rates, financial access, solar system's capacity, improvement in farmers income and the environmental benefits. With centralized data system, controlled within the national coordination body should aggregate information from local governments, cooperatives, implementing partners while capturing real time information for decision making. Additionally, quarterly reports on years' progress combined with data are used to measure success of policy intervention. These reports should be submitted through multi-stakeholder forums to ensure accountability and transparency. Further, engaging independent evaluations to assess impact, while refining strategies and lessons learned across the regions to enhance cross-border learning and continuous improvement.

A clear structure of incentives such as subsidies and tax exemption is necessary for Agri-solar to become viable and attractive to smallholder farmers. Consequently, Agri-solar promotes efficient water use and creates economic opportunities for youth and women, especially with alignment to national goals on food security and climate action, however, high upfront cost has become a barrier to adoption of solar solution.

Blended financing models have enhanced affordability and reach, particularly when complemented with innovative mechanisms such as PAYG and leasing, thus should be promoted. PPPs have remained effective in aligning resources hearing risks and expanding reach of Agri-solar solutions, making them more accessible, affordable and impactful to smallholder farmers. Furthermore, regional coordination collaboration remains vital for harmonizing standards, scaling best practices, and accelerating Agri-solar adoption across East Africa.

Other specific recommendations

Action	Key Steps	Timeline	Lead Institutions	Supporting Actors	Success Indicators
1. Fast-track the adoption of harmonized	- Finalize EAC renewable energy	12–18 months	EAC Secretariat (Energy Department),	National Bureaus of Standards,	- Harmonized EAC agrisolar

EAC renewable energy standards, including agrisolar product certification	standards framework. - Include agrisolar-specific components (pumps, dryers, irrigation). - Mandate product certification and labeling. - Train national standards agencies.		East African Standards Committee	EPRA (Kenya), UNBS (Uganda), TBS (Tanzania), Private sector associations	standards published. - Product certification adopted by all member states. - Reduction in counterfeit solar products.
2. Establish and implement frameworks for mutual recognition of agrisolar technicians and certification across EAC countries	- Develop regional curriculum and competency framework. - Create a mutual recognition agreement (MRA). - Set up regional registry of certified technicians.	18–24 months	EAC Skills Council, EAC Secretariat (Education & Skills)	TVET institutions, Professional associations, Private sector	- Standardized agrisolar technician curriculum. - MRA signed by all EAC states. - Technician mobility increased by 30%.
3. Simplify cross-border trade processes for solar equipment through a single-window clearance system	- Develop digital single-window platform for customs and standards clearance. - Harmonize duty exemptions for agrisolar components. - Train customs and border officers on harmonized procedures.	18–30 months	EAC Trade Directorate, EAC Customs Management	Revenue authorities (KRA, URA, TRA), Energy regulators	- Single-window system operational across EAC. - Reduction in clearance time by 40%. - Uniform application of duty exemptions.
4. Create an EAC Agrisolar Coordination Task Force to align national strategies and	- Form task force under EAC Secretariat. - Hold bi-annual	6–12 months (setup), ongoing thereafter	EAC Secretariat, Regional Energy & Agriculture Committees	National energy & agriculture ministries, Development partners (USAID, Power	- Task Force established and operational. - Regional agrisolar

regulatory frameworks	policy alignment meetings. - Develop a joint investment and knowledge-sharing platform.			Africa, SNV, PREO)	roadmap adopted. - \$50M+ mobilized for regional programs within 3 years.
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ANNEXES I: AGRI-SOLAR POLICIES AND FRAMEWORKS IN KENYA, UGANDA AND TANZANIA

Country	Policy Framework	Legislative Framework	Responsible organization	Aim
KENYA	Kenya National Energy Policy (2018)	Energy Act, 2019	Ministry of Energy; Energy and Petroleum Regulatory Authority (EPRA); Rural Electrification and Renewable Energy Corporation (REREC); County Governments	Promotes renewable energy, including decentralized solar technologies, with mention of productive use in agriculture.
	Kenya National Electrification Strategy 2018 (KNES)	Energy Act 2019,	Ministry of Energy; Energy and Petroleum Regulatory Authority (EPRA); Rural Electrification and Renewable Energy Corporation (REREC); County Governments'; KETRACO	Promotes a technology-neutral approach with a strong focus on off-grid solar for remote areas. It supports private sector involvement by creating an enabling environment for Pay-As-You-Go solar and solar irrigation systems.
	National Energy Efficiency and Conservation Strategy (NEECS) 2020	Energy Act 2019	Centre for Energy Efficiency and Conservation (CEEC), Ministry of Energy; Energy and Petroleum Regulatory Authority (EPRA); Rural Electrification and Renewable Energy Corporation (REREC); County Governments	Provides a legislatively anchored, multi-sector roadmap to boost energy efficiency and conservation in Kenya
	Draft Energy (Solar Photovoltaic Systems) Regulations, 2020; Energy (Appliances Energy Performance and Labelling) Regulations 2016; Draft Energy (Mini-grid) Regulations 2022	Energy Act 2019	Energy and Petroleum Regulatory Authority (EPRA)	Existing regulatory documents govern the off-grid solar and mini-grid sectors, including electric appliances and equipment. Focusing on legislative authority and institutional duties in Kenya
	National Agricultural Mechanisation Policy 2021	The Constitution of Kenya (2010)	Ministry of Agriculture, Livestock, Fisheries and Cooperatives County Governments	Its multi-pronged strategy aims to enhance farm productivity, expand mechanisation, ensure

		Agriculture and Food Authority Act (2013)	Agricultural Sector Coordination Unit (ASCU) Agricultural Technology Development Centres (ATDCs) and KALRO	quality, deliver training, and scale financing — all aligned with national economic transformation goals.
	Irrigation Act No. 14 of 2019	The Constitution of Kenya (2010)	National Irrigation Board	This act touches on community-based smallholder irrigation and drainage schemes, but not on the energy source to be used
	National Climate Change Action Plan (NCCAP)	Climate Change Act, 2016	Ministry of Environment (Climate Change Directorate) National Climate Change Council (chaired by the President)	Provides a comprehensive framework to guide Kenya's mitigation and adaptation actions. It promotes renewable energy technologies.
	National Irrigation Sector Investment Plan (NISIP), 2025	National Irrigation Policy 2017 Irrigation Act (2019)	National Water Harvesting & Storage Authority (NWHSA) State Department for Irrigation (Ministry of Water, Sanitation & Irrigation)	This integrated framework aims to scale sustainable irrigation, enhance food security, and attract private investment into Kenya's agricultural future
UGANDA	Renewable Energy Policy (2007)	Electricity Act (1999)	Ministry of Energy and Mineral Development (MEMD) Electricity Regulatory Authority (ERA) Rural Electrification Agency (REA)	Guides the promotion of renewable energy, including solar, mini-hydro, biomass, and wind, with targets for increasing rural electrification and encouraging private sector participation
	Energy Policy for Uganda (2002)	Electricity Act (1999)	Rural Electrification Planning & Coordination Uganda Energy Credit Capitalisation Company (UECCC)	Aims to ensure adequate, affordable, and reliable energy supply while encouraging renewable energy and private investment.
	National Energy Policy (draft 2019 update)	Electricity Act 1999	Ministry of Energy and Mineral Development (MEMD) Electricity Regulatory Authority (ERA) Rural Electrification Agency (REA) / UECCC UECCC (Uganda Energy Credit Capitalisation Company)	Seeks to strengthen frameworks for off-grid and clean energy technologies, including solar PV and solar-powered irrigation

	National Climate Change Policy (2015)	Climate Change Act (2021)	Ministry of Water and Environment National Environment Management Authority (NEMA)	Sets out cross-sector climate change measures and adaptation plans, supporting climate-smart agriculture and renewable energy integration.
	National Agriculture Policy (2013)	Constitution of 1995	Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) District & Local Governments Agricultural Training Institutes & Universities	Provides the framework to transform agriculture from subsistence to commercial farming; encourages mechanisation, irrigation, and value addition
	Agriculture Sector Strategic Plan (ASSP) 2020–2025	Constitution of Uganda (1995), Uganda Vision 2040, and the National Development Plan III (2020–2025)	Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) District Local Governments (DLGs)	Operationalises the agriculture policy, targeting productivity, climate-smart agriculture, and agribusiness promotion
	Irrigation Policy (2018)	Irrigation Act, 2019 (Cap. 347) Irrigation (General) Regulations, 2021	Ministry of Agriculture, Animal Industry & Fisheries (MAAIF) Ministry of Water and Environment (MWE)	Supports expansion of irrigation infrastructure, farmer-led irrigation models, and efficient water use technologies.
TANZANIA	National Energy Policy (2015)	<i>Electricity Act, 2008</i> Energy and Water Utilities Regulatory Authority Act, 2001	Ministry of Energy Rural Energy Agency (REA) Energy and Water Utilities Regulatory Authority	Promotes the development and uptake of renewable energy sources, recognizing their role in enhancing energy security and sustainability
	National Agriculture Policy (2013)	Agricultural Inputs Trust Fund Act, 1994 Cooperative Societies Act, 2013	Ministry of Agriculture	It emphasizes the modernization of agricultural sector through the adoption of improved technologies. The policy aims to support agricultural mechanization and the expansion of irrigation infrastructure, areas in which solar energy plays a transformative role.
	National Irrigation Policy (2010)	National Irrigation Act, 2013	Ministry of Agriculture National Irrigation Commission (NIRC)	It promotes climate-resilient irrigation infrastructure. Solar-powered pumping and irrigation systems align well with this policy.

	Five-Year Development Plan III (FYDP III, 2021–2026)	Planning Commission Act, 1989 Public Finance Act, 2001 Budget Act, 2015	Ministry of Finance and Planning Ministry of Agriculture Ministry of Energy	The policy prioritizes improving energy access and developing irrigation infrastructure as part of its strategy to boost productivity.
	National Climate Change Strategy (2012)	Environmental Management Act, 2004	Division of Environment under the Vice President's Office National Environment Management Council (NEMC)	It recognizes renewable energy as a key adaptation and mitigation measure in addressing climate risks.
	National Energy Master Plan (2022–2023)	Energy Act, 2015	Ministry of Energy (MoE); Tanzania Electric Supply Company (TANESCO)	Providing a detailed roadmap for energy sector expansion, investment planning, and infrastructure development
	National Clean Cooking Strategy 2024-2034	Environmental Management Act, 2019 and Energy Act, 2004	Ministry of Energy; Ministry of Environment	To increase access to clean cooking technologies, reducing health risks and environmental degradation
	National Renewable Energy Strategy 2024-2034	Renewable Energy Feed-in Tariffs (REFIT), Energy Act	Ministry of Energy; Tanzania Renewable Energy Association (TAREA)	To increase the share of renewable energy in the energy mix and promote sustainable energy sources
	Renewable Energy Feed-in Tariff Framework (Small Power Producers Framework, 2015)	Electricity Act, 2008 Energy Policy 2015	Energy and Water Utilities Regulatory Authority (EWURA) Tanzania Electric Supply Company Limited (TANESCO)	It provides a legal pathway for small-scale renewable energy producers to connect to local mini-grids and sell excess electricity. It targets electricity generation, but it is relevant to Agri-solar systems where farmers may generate surplus solar power beyond their agricultural needs.

ANNEX II: REGIONAL AGRI-SOLAR POLICIES AND FRAMEWORKS

Regional Body	Policy Framework	Legislative Framework	Responsible organization	Aim
East African Community	EAC Energy Policy (2018)	Treaty for the Establishment of the East African Community (1999) Energy Bill, 2013	EAC Council of Ministers and national ministries of energy	It promotes renewable energy integration, cross-border interconnections, and harmonization of energy standards.
	EAC Climate Change Policy (2011)	EAC Climate Change Master Plan (2011–2031)	EAC Sectoral Council on Environment and Natural Resources	Supports adaptation measures, including climate-smart agriculture and renewable energy.
	EAC Vision 2050	EAC Treaty (1999)	EAC Secretariat Strategic Planning and Vision Coordination Unit	It supports regional cooperation in modernizing agriculture and expanding renewable energy infrastructure.
	EAPP (Eastern Africa Power Pool)	Intergovernmental Memorandum of Understanding signed in 2005	EAPP Secretariat	It facilitates electricity trade across borders, becoming relevant for Agri-solar systems feeding excess solar energy to local grids.
Common Markets for Eastern and Southern Africa (COMESA)	Renewable Energy Policy Framework 2015	COMESA Treaty (1993)	COMESA Secretariat, Infrastructure & Energy Division	It aims to promote cross-border cooperation on renewable energy projects among member states, encouraging regional collaboration to expand clean energy access.