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Joint EU-AU policy report on the enabling policy framework

Authors : Dr. Manfred HAFNER (HEAS), Manfred Hafner (HEAS), Giacomo Falchetta (IIASA), Philippe Copinschi (HEAS), Edward Byers (IIASA), Adriano Vinca (IIASA), Gregory Ireland (UCT), Alison Hughes (UCT), Fabio Inzoli (PoliMi), Simon Rukera-Tabaro (UR), Francesco Semeria (PoliTo), Marta Tuninetti (PoliTo), Ackim Zulu (UNZA)

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Author(s)	Dr. Manfred HAFNER, Manfred Hafner (HEAS), Giacomo Falchetta (IIASA), Philippe Copinschi (HEAS), Edward Byers (IIASA), Adriano Vinca (IIASA), Gregory Ireland (UCT), Alison Hughes (UCT), Fabio Inzoli (PoliMi), Simon Rukera-Tabaro (UR), Francesco Semeria (PoliTo), Marta Tuninetti (PoliTo), Ackim Zulu (UNZA)
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Summary

Joint EU-AU policy report on the enabling policy framework. This deliverable briefs African policymakers and business actors on the main results emerged from the RE4AFAGRI project in terms of the recommended policies, regulatory frameworks, business models, public-private partnership, and science-policy interfaces to achieve an energy-enabled, sustainable transformation of the agricultural sector in sub-Saharan Africa that is empowering smallholder farmers and local communities while contributing to industrial development and is aware of planetary boundaries and environmental resource sustainable management.

Approval

Date	By
2024-04-19 13:59:12	Dr. Manfred HAFNER (HEAS)
2024-04-22 12:03:43	Mr. Léonard LéVêQUE (LGI)

LEAP-RE

Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy

Joint EU-AU policy report on the enabling policy framework as deliverable for Task 12.6

Deliverable D12.8

WP12 of LEAP-RE (RE4AFAGRI)

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Authors: Manfred Hafner (HEAS), Giacomo Falchetta (IIASA), Philippe Copinschi (HEAS), Edward Byers (IIASA), Adriano Vinca (IIASA), Gregory Ireland (UCT), Alison Hughes (UCT), Fabio Inzoli (PoliMi), Simon Rukera-Tabaro (UR), Francesco Semeria (PoliTo), Marta Tuninetti (PoliTo), Ackim Zulu (UNZA)

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Acronyms

IIASA: International Institute for Applied Systems Analysis

LEAP-RE: Long-Term Joint Research and Innovation Partnership on Renewable Energy between the European Union and the African Union

M-LED: Multisectoral Latent Electricity Demand assessment tool

MESSAGEix: Model of Energy Supply Systems And their General Environmental Impact

NEST: NExus Solutions Tool

OnSSET: Open Source Spatial Electrification Tool

POLITO: Politecnico di Torino

RE4AFAGRI: Renewable Energy for African Agriculture – Modelling Excellence and Robust Business Models

SSA: Sub-Saharan Africa

UCT: University of Cape Town

WaterCROP: Water Crop assessment model

1. Background

Multi-dimensional and overlapping Nexus challenges affect many parts of rural sub-Saharan Africa. More than 90% of cropland is rainfed, >15% report insufficient food intake and >40% live below the poverty line. Climate change impacts on vulnerable systems with limited adaptive capacity and strong population growth are increasing the magnitude of the challenge. At the core of these deprivations, smallholder farmers are being left behind. Responsible for 80% of sub-Saharan Africa's agricultural output, smallholder farmers are the breadbasket of the region. Yet, despite this critically important role, these farmers are largely neglected, often living outside the reach of critical infrastructure. Electricity, which plays a vital role in agricultural productivity, remains especially elusive. In these rural areas, only 29% of the population has access to electricity and of these, 80% are smallholder farmers. Electrification is simply not happening fast enough and these populations are being unfairly left behind.

To address these challenges, there is a need for agricultural transformation to ensure increased revenue opportunities and food security of the smallholder farmers of the continent. The input of electric energy provides a foundational building block upon which significant development becomes possible. Access to affordable energy enables pumping groundwater, rainwater harvesting and storage in underground or surface storage tanks, and powering crop processing and cold storage machineries that could significantly contribute to poverty elimination. This would have positive consequences for food security (SDG 2), ensuring healthy life (SDG 3), ensuring equitable and inclusive education (SDG 4), access to water (SDG 6), access to energy (SDG 7) and local socio-economic development (SDG 8), thus contributing to the reduction of rural-urban and gender inequalities (SDG 10). Accelerating the pace of electrification and balancing these inequalities requires a fundamental shift in how electrification interventions, especially those in rural areas, are designed and implemented.

The **LEAP-RE Pillar 2 WP12 (RE4AFAGRI)** project aims at informing and contributing to the transformation of the African smallholder farmers' agriculture and demonstrate planning and implementation approaches to the integrated water-energy-food-environment-economic development nexus management and business models for infrastructure implementation that are truly tailored to the local needs and socio-cultural and economic and financial context. To achieve these aims, RE4AFAGRI combines modelling tools for informed policymaking with tools for identifying high-potential electrification sites and assessing financial viability of electrifying specific smallholder irrigation and agro-processing activities such as grain grinding, threshing and drying. This framework provides insights into the future vulnerability of water, energy and land resources and how multi-sectoral policies, technological solutions and investments can improve the resilience and sustainability of transformation pathways. Together, these tools enable policymakers, investors and practitioners to manage the interlinkages between water, energy, food, environment and economic development, which in turn enables infrastructure development tailored to local socio-cultural, cultural and financial needs. The full suite of tools also includes a user-friendly techno-economic model that determines the financial viability of irrigation and agro-processing equipment uptake among smallholder farmers.

This deliverable briefs African policymakers and business actors on the **main results emerged from the RE4AFAGRI project in terms of the recommended policies, regulatory frameworks, business models, public-private partnership, and science-policy interfaces** to achieve an e**nergy-enabled, sustainable transformation of the agricultural sector in sub-Saharan Africa that is empowering**

smallholder farmers and local communities while contributing to **industrial development and is aware of planetary boundaries and environmental resource sustainable management.**

2. Main research findings

- To meet the crop evapotranspiration needs and close the irrigation gap in currently rainfed cropland (green water-irrigated only) of SSA, we estimate add**itional crop blue water demand of 67 km3/y, corresponding to a total yearly blue water withdrawal of 175 km^3/y (i**nclusive of losses) from surface and ground water bodies. This figure implies a **near doubling** from the current total water withdrawals of the entire African continent (215 km 3 /y).

- The wide irrigation gap to meet crop evapotranspiration can be addressed with investment in irrigation technologies and infrastructure, along with investments in energy supply. **We estimate that the investment required to improve irrigation might overcome significantly the magnitude required for energy supply**. This means there is room for investors and companies in the irrigation sector to be included in the development and planning discussion on regional infrastructure development.

- Electricity demand will grow significantly in the residential and heavy industry sectors. However, to promote electricity access expansion and stimulate the demand in rural areas, there is need for **integrated policies that promote water pumping and crop processing and storage machinery uptake and utilisation**. The magnitude of agricultural demand (and thus prospects for sectoral development) remain limited in the absence of such polices.

- Scenarios with increased ambition in expanding irrigation and agricultural productivity result in **improved diffusion and economic feasibility of mini-grid infrastructure to provide universal energy access. This means that there is high economic potential for combined mini-grid and irrigation development, with positive impacts on both energy-consuming productive activities and residential electricity access.** The rapid uptake of such decentralised energy access infrastructure is particularly crucial over the short and medium-run (2030). Failure to acknowledge such synergies results in lack of economic and financial viability to install such decentralized infrastructure, and in turn likely persistent energy poverty and economic stagnation.

- **The business case for value chain electrification in sub-Saharan Africa is, in many cases, positive, as evidenced by the techno-economic study conducted for select countries in this project.** The ingredients to successful deployment are universal: With agro-processing, ensure that throughput is maximised. This is the single most impactful way to improve the economics of agro-processing. With irrigation, support smallholder farmers to practise crop rotation techniques between staples and cash crops enable faster recovery of capital expenditure.

- **The off-grid renewable energy technologies to deliver electricity to value chain activities are proven.** Focus on positioning agro-processing equipment facilities in villages and power them with alternating current electricity from mini-grids. Educate smallholder farmers on the use of standalone solar water pumps on-farm, to save costs that would otherwise have been incurred to extend mini-grid power lines to pumps on farms.

- **The foundational principles of successful agri-energy nexus business models are clear.** PAYGO models improve affordability by avoiding high upfront capital expenditures, Keymaker models connect smallholder farmers with downstream markets which facilitate higher profit margins for their crops and community-centred business models ensure longevity as a result of community buy-in.

- **The ingredients for favourable macro-operating environments are known.** Regulations and taxes should not impede energy access operations unnecessarily, financing should be readily available and infrastructure should allow for efficient operations. In Nigeria, regulations create a healthy operating environment. In Rwanda, clear regulations are in place, but the low priority given to the off-grid sector by the government means that the industry remains small. Zambia has a well-crafted legislation in place, but its continued draft status stifles growth, while the market in Zimbabwe would benefit from the introduction of regulations. While some countries perform better than others on financing availability, companies across the board generally find it difficult to source suitable financing. Infrastructure such as mobile money performs relatively well in most countries, while physical access to rural areas remains a challenge.

- **What remains is the need for more practical experience with these business models in a variety of macro-operating environments among a larger proportion of off-grid and mini-grid companies.** This project has showcased examples of the key agri-energy business models used by companies to adequately serve smallholder farmers. Key to disseminating best practices discussed in this report is the open sourcing of techniques such as the techno-economic model (downloadable here**)** and facilitating experiments with companies on the use of the demand-led business models discussed in this report. Transparency of and the flexibility to modify such tools is key to building trust and increasing uptake.

3. Implications for public decision makers

- A successful implementation of integrated water-energy-agriculture granular infrastructure requires however coordination and planning between mini-grid developers, farmers and local governance. In the long-run, communities still lacking access to electricity are eventually reached by the national grid and mini-grid providers will have the chance to also connect to the national grid.

- Another important implication is that the switch towards mini-grid systems as a result of higher productive demand is relatively strong already in an intermediately ambitious scenario, compared to the baseline scenario, suggesting that even moderate agricultural productive demand stimulation can have a beneficial effect in making mini-grid systems that provide community-wide energy access more feasible and widespread.

- Yet, energy access business models targeting smallholder farmers require favourable operating environments to succeed. Regulations should allow for clear operating procedures with limited bureaucracy. Companies should ideally have sufficient access to finance to operate and grow their businesses and the physical and digital infrastructure (for example digital mobile money payments) to implement business models.

- To implement granular water-energy infrastructure on the ground at a large scale, private capital (also as part of public–private partnerships) is indispensable. Incentives to mobilize private capital through tax breaks on renewable energy investments and technologies can increase the attractiveness.

- For energy access business models to be deployed easily, various types of primary infrastructure needs to be in place, from national-level physical and digital infrastructure to company-specific internal infrastructure (e.g. digital infrastructure such as risk assessment processes, management information systems, ERPs and systems to analyse repayment capacities of customers).

- Public–private local research and development (R&D) programs in the sector—both nationally and regionally—are a necessary condition for tapping the estimated techno-economic potential: enabling regulatory, market and governance conditions are in fact crucial to ensure a lower cost of capital and market penetration of private capital for decentralized service supply technologies.

- It is the responsibility of public decision-makers to create the right policies, incentives, and investment environment for private companies to develop, install, and manage this infrastructure and deploy solar irrigation on a large scale and farmers to invest and gain capacity to use these. Future uptake will largely depend on government subsidies (particularly

for upfront capital loans) and regulatory reform, as well as on the use of consumer financing models by solar pump supplying companies, as it is estimated that it generally takes 6–12 months of income for a typical farming household to cover upfront system costs. Smallholder farmers typically do not have sufficient disposable income to pay large lump sums upfront. Financing models that are tailored to smallholder farmers' income patterns are advised. These include lease-to-own and pay-as-you-go models.

- Another key challenge to ensure increased technology adoption and sustained utilization is the consideration of technical knowledge and materials availability, including technical skills to perform ongoing maintenance and repairs, as well as social norms and structures, such as the acceptability of technology and the establishment of shared ownership models for groups of farmers and smallholder consortia. This goes beyond the sole infrastructure uptake issue, but it also includes consideration of capacity development over farming practices, including irrigation management, fertilization, pest control, crop rotation, and extensification–intensification trade-offs.

- Small-scale, distributed irrigation infrastructure, in particular when sprinklers and pumps are used, requires intensive maintenance and water withdrawals need to be monitored by dedicated public authorities to avoid 'tragedy-of-the-commons' issues, such as overuse of water, declining groundwater tables, and salinization. Sustainable irrigation requires strong institutions responsible for developing and enforcing rules to avoid unsustainable water use practices, which will be a key development priority for SSA policymakers. The development of local community structures to "self-police" sustainable irrigation can strongly contribute to this aim.

- Financial viability is substantially improved when farmers grow crops for two seasons (and even better when a cash crop is cultivated in the second season), when the upfront cost of the equipment is reduced, when the price that the farmer can sell their crop for is increased and when the throughput per hour of a processing machine is increased. Agricultural extension programmes that support smallholder farmers to sell their crops in downstream markets (where crop prices are higher), e.g. major towns, is a useful tool that policymakers can use in increasing farmers' crop prices and in turn the financial viability of the solar water pump irrigating the same crops.

- Regulations have a significant impact on the favourability of an enabling environment. For example:
    - **Licensing and permitting:** Should ideally not be too onerous for energy access companies;
    - **Tariffs and price ceilings:** Cost-reflective tariffs and prices should ideally be permitted;
    - **Quality standards:** Quality standards should ideally aim for consumer protection, without being set at a level that is too high (which unnecessarily increases the cost base for suppliers);

- **Import duties and other taxes:** Renewable energy components should ideally be exempted from import controls, duties and taxes so as to allow the sector to scale up.

4. Implications for private developers and investors

- Private sector developers and suppliers of DRE equipment for smallholder farmers would be well advised to intricately analyse the creditworthiness of customers beforehand and compare their ability to pay for energy services with a detailed projection of the financial liability that they would incur when buying a particular system (e.g. solar water pump or agro-processing machine). All too often customer contracts fail because equipment that is too expensive is sold to a smallholder farmer. Projection of a customer's financial liability can be estimated using standard techno-economic models, while assessments of creditworthiness can be done through in-country credit scoring services.

- High capital cost and interest rates represent a key barrier for successful large-scale uptake of decentralized energy infrastructure in the region. These factors depend on the quality of national and regional regulatory frameworks (for example taxation and import duties) and institutional arrangements.

- A lever additional to end-user cost reduction is consumer finance schemes (such as pay-as-you-go or lease-to-own models) whereby customers pay for their equipment over time. Digital technologies and systems such as mobile money enable suppliers to transact seamlessly with customers and policymakers would be well advised to create favorable conditions for development of the mobile money ecosystem, such as the reduction of taxes on mobile money payments.

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