Horizon 2020 Programme

LEAP-RE

Research and Innovation Action (RIA)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 963530

Start date : 2020-10-01 Duration : 72 Months
http://www.leap-re.eu/

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

Policy Recommendations Guidelines and Roadmap including the outcome on scientific collaboration.

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LEAP-RE - Contract Number: 963530

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Document title	Policy Recommendations Guidelines and Roadmap including the outcome on scientific collaboration.
Author(s)	Nebiyu GIRGIBO
Number of pages	21
Document type	Deliverable
Work Package	WP14
Document number	D14.11
Issued by	UVA
Date of completion	2025-10-06 13:55:29
Dissemination level	Public

Summary

The Sustainable Development Goal 7 (SDG7) addresses the access of affordable clean energy that can be achieved by the sustainable use of renewable energy resources. In Uganda, the policy recommendations are related to Governance, Electrification, Solar home systems, Mini grids, and Energy policies for humanitarian settings. In Botswana, energy related legislation is administrated by the Department of Energy (DoE) of the Ministry of Mineral Resources, Green Technology and Energy Security (MMGE) and the Botswana Energy Regulatory Authority (BERA). Energy policies in Ethiopia focus on enhancing energy security, expanding access to electricity, and promoting the use of renewable energy sources to support sustainable development and economic growth. The Government of the Republic of Kenya has prioritized renewable energy sources and sought to expand its share in its overall power development plan for the period 2017 to 2037. Developing a roadmap for an energy village involves a series of structured steps to ensure successful implementation and sustainability. The process begins with a comprehensive assessment of the community's energy needs and resources, identifying suitable renewable energy sources and potential installation sites. As a conclusion that a long-term AU-EU partnership can be used for supporting the strengths for establishing energy villages across the African and thus harnessing the opportunities for local people. It can also be used for overcoming the weaknesses and avoiding the threats related to greater the utilization of renewable energy.

Approval

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2025-10-14 15:59:03	Léonard LéVêQUE (LGI)

LEAP-RE

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

Research & Innovation Action

September 2024

D14.11 - Policy Recommendations Guidelines and Roadmap including the outcome on scientific collaboration

as a deliverable for WP14

Version - Final

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This project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement 963530.

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Document information

Grant Agreement	963530
Project Title	Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy
Project Acronym	LEAP-RE
Project Coordinator	Vincent Chauvet – LGI
Project Duration	1st October 2020 – 30 September 2026 (72 Months)
Related Work Package	WP14 Energy Village
Related Task(s)	D14.11 Policy Recommendations Guidelines and Roadmap including the outcome on scientific collaboration
Lead Organisation	Mak
Contributing Partner(s)	BIUST, AASTU, MaK, Moi and UVA
Due Date	9/30/2024
Submission Date	10/6/2025
Dissemination level	Public

History

Date	Version	Submitted by	Reviewed by	Comments
30-07-2024	V1	MaK, UVA, AASTU, Moi, BIUST	MaK	All partners
03.07.– 16.09.2024	V2-V4	MaK, UVA, AASTU, Moi, BIUST	MaK and UVA	All partners
30.09.2024 and 16.09,17.09 and 06.10.2025		UVA	All partners	All partners

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Abbreviations and Acronyms

Acronym	Description
WP	Work Package
AASTU	Addis Ababa Science and Technology University
BIUST	Botswana International University of Science and Technology
MU	Moi University
MaK	Makerere University
UVA	University of Vaasa
SDG	Sustainable Development Goals
DoE	Department of Energy
MMGE	Ministry of Mineral Resources, Green Technology and Energy Security
UNDP	United Nations Development Program
NCCSAP	National Climate Change Strategy and Action Plan
IPPs	Independent Power Producers

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Summary

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Developing a roadmap for an energy village involves a series of structured steps to ensure successful implementation and sustainability. The process begins with a comprehensive assessment of the community's energy needs and resources, identifying suitable renewable energy sources and potential installation sites.

As a conclusion that a long-term AU-EU partnership can be used for supporting the strengths for establishing energy villages across the African and thus harnessing the opportunities for local people. It can also be used for overcoming the weaknesses and avoiding the threats related to greater the utilization of renewable energy.

Keywords: Energy Village; Renewable Energy; Policy Recommendations; LEAP-RE; Sustainable Development Goal

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1. Introduction

The Sustainable Development Goal 7 (SDG7) addresses the access of affordable clean energy that can be achieved by the sustainable use of renewable energy resources. SDG7 should guide countries worldwide to shape their renewable energy and electricity supply policies and regulatory framework. Shaping a countries' renewable energy future strongly depends on the governance and mechanism of the respective valid legal situation in terms of energy policies and regulations. Different countries across the globe and specifically Africa have policies that were designed to foster a faster achievement of SDG7. These policies range from regulatory frameworks, governance, quality assurance and public-private partnership engagements.

Table 1 provides a list of energy villages that were chosen and modelled in the partner countries of the LEAP-RE WP14 Energy Village Africa. The policy regulations in both national and international will be discussed in the following sections.

Table 1: List of energy villages in Africa chosen.

S/N	Energy village	Country
1	Cheboiwo, Langas, Nandi Hills, Kerio Valley, Lelan	Kenya
2	AASTU, Tulefa, Wonji and Langano	Ethiopia
3	Regent Hill School, Regent Hill School, Jamataka, Majwannaadipitse, Matsaudi	Botswana
4	Nakasengere, Wanale, Refugee Camp, Maziba Murole and Kayanzi	Uganda

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2. List of policies, guidelines and roadmaps in the respective countries and local areas

The energy policies, guidelines and roadmaps for Uganda, Botswana, Ethiopia and Kenya were elucidated in the following subsections.

2.1. Uganda

In Uganda, there has been a number of policy interventions to improve on the energy accessibility of across the country. These were documented in the energy policy framework of 2023 [1]. The policies looked at the following dimensions.

- Governance: A number of agencies were set up to ensure the attainment of national development goals in as far as energy access are concerned. These bodies enforce policies, regulations and controls of the sector players.
- Electrification: Over the years, the government has pursued several programs geared towards expanding the grid networks and increased electrification. This has been done in coordination with private players in the sector. Therefore, the energy village models can fit into the sector players to focus on rural communities' energy self-sufficiency.
- Solar home systems: There is a policy in place that governs the players in the solar home systems. This has seen a recommendable increase in these players between 2018-2022.
- Mini grids: There is a regulatory framework that permits establishment of the Mini grid systems. There are over 60 Mini grids operational across the country. Most of which are solar Mini grid systems. Therefore, establishment of mini grid systems in these energy villages across the country is within the existing policy frame work.

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- Energy policies for humanitarian settings: Due to the fact that Uganda hosts a number of refugees and asylum seekers, there are some policies that were set by the UN Refugee Agency together with the government in respect to humanitarian energy access [2]. This policy focused on scaling up the use of the efficient energy conversion system and protection of the environment.

2.2. Botswana

In Botswana, energy related legislation is administrated by the Department of Energy (DoE) of the Ministry of Mineral Resources, Green Technology and Energy Security (MMGE) and the Botswana Energy Regulatory Authority (BERA). In this context, Botswana aims at reducing the carbon emissions by 15% until 2030 compared with to the base year 2010 (by using 8307 Gigagrams of Carbon Dioxide equivalent or CO_2e as a baseline). Therefore, Botswanan has developed the UNDP National Climate Change Strategy and Action Plan (NCCSAP) in 2018 [3]. The transformational Vision 2036 gives the frame and defines the national objectives for Botswana's future development and includes a holistic sustainable energy perspective, being defined by the attribute's availability, accessibility, safety, affordability, reliability and environment-friendliness [4]. The four pillars of Vision 2036 are;

(i) Sustainable economic development
(ii) Human and social development
(iii) Sustainable environment and
(iv) Governance, peace and security

Recently, a revision of a National Energy Policy was approved by the Parliament of Botswana in 2021 showing a Botswana's commitment to transform the energy sector from fossil sources to renewable energy sources [5]. The main focus of the National Energy Policy is on the access to affordable, reliable, and sustainable energy in view of the 4 pillars defined

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in Vision 2036. A key element is the expansion of renewable energy sources, such as Photovoltaics and Biomass. To achieve this, a particular focus is on the private sector participation in the provision of renewable energy, including Independent Power Producers (IPPs) for larger renewable energy generation projects.

In 2020, the government of Botswana launched the Rooftop Solar Programme (RTS) that allows domestic and C&I consumes to install solar systems to generate electricity for self-consumption and to feed the produced excess electricity to the grid, that is to say, sell the produced excess electricity to Botswana Power Cooperation (BPC).

2.3. Ethiopia

Energy policies in Ethiopia focus on enhancing energy security, expanding access to electricity, and promoting the use of renewable energy sources to support sustainable development and economic growth. Ethiopia's energy sector is predominantly based on renewable energy, particularly hydropower, which accounts for the majority of the country's electricity generation. The government has prioritized the development of additional hydropower projects, as well as wind, solar and geothermal energy sources to diversify the energy mix and reduce dependence on fossil fuels.

Ethiopia has been carrying out various practical policy and action interventions as a step to contribute to emission reduction and building adaptation capacity. Key policies and initiatives include the National Energy Policy, which aims to provide affordable, reliable, and sustainable energy to all citizens. This policy emphasizes rural electrification to improve access to electricity in remote areas, recognizing that only a fraction of the rural population currently has reliable energy access. The development plans and the energy policies outline ambitious targets for expanding renewable

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energy capacity, improving energy efficiency, and fostering private sector investment in the energy sector.

Additionally, Ethiopia's Climate Resilient Green Economy (CRGE) strategy aims to achieve middle-income status while developing a green economy. This strategy includes initiatives to increase renewable energy production, enhance energy efficiency, and reduce greenhouse gas emissions. The government also seeks to strengthen regional energy integration through projects like the Eastern Africa Power Pool (EAPP), which aims to connect Ethiopia's energy grid with neighbouring countries to enhance regional energy trade and security.

Overall, Ethiopia's energy policies are geared towards leveraging the country's abundant renewable energy resources to meet growing energy demands, promote economic development, and achieve environmental sustainability.

Ethiopia's energy policies strongly support the establishment and expansion of energy villages, contributing to enhanced energy access, sustainability, and community development. The energy policies emphasize increasing access to affordable, reliable, and sustainable energy, particularly in rural areas where energy villages can play a crucial role. By prioritizing rural electrification, these policies ensure that remote communities benefit from renewable energy sources, reducing reliance on traditional biomass and improving quality of life.

The focus on renewable energy in Ethiopia's energy policies aligns with the energy village concept, which relies on locally available renewable resources such as solar, wind, and small-scale hydro power. The government’s support for diverse renewable energy projects, as outlined in the Climate Resilient Green Economy (CRGE) strategy, provides a conducive environment for energy villages to thrive. This strategy aims to increase

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renewable energy production, enhance energy efficiency, and reduce greenhouse gas emissions, directly benefiting energy villages by fostering sustainable and resilient energy solutions.

Furthermore, Ethiopia's commitment to regional energy integration through initiatives like the Eastern Africa Power Pool (EAPP) enhances the potential for energy villages to connect to a broader energy network, facilitating energy trade and improving energy security. Policies that encourage private sector investment and public-private partnerships also provide financial and technical support necessary for the development of energy villages.

It can be said that, energy policies create a supportive framework for the establishment and growth of energy villages by promoting renewable energy, prioritizing rural electrification, enhancing energy efficiency, and encouraging regional energy integration. These policies help energy villages to contribute to sustainable development, improve local economies, and ensure energy security and environmental sustainability.

Table 2: List of Energy Policies in Ethiopia.

S/N	Policy title	Author
1	National Energy Policy of Ethiopia	Mekdes Mezgebu
2	Energy policy of Ethiopia	Melis Teka
3	Energy policy of Ethiopia	Ministry of Mines and energy
4	Scaling - Up Renewable Energy Program Ethiopia Investment Plan (Draft Final)	Federal Democratic Republic of Ethiopia: Ministry of Water and Energy
5	Ethiopia energy policy (2nd draft)	Mistry of water and energy
6	Ethiopia key indicators and policy initiatives	IEA
7	Ethiopia Renewable Energy	International trade administration

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8	Climate Resilient Green Economy (CRGE) Strategy	Ministry of Finance of Ethiopia
9	Ethiopia: Climate Change Laws of the World	Grantham research institute on climate change and the environment
10	National energy policy: Ethiopia	Food and agriculture organization
11	SDG7 Energy Compact of Ethiopia	United nations

2.4. Kenya

The Government of the Republic of Kenya has prioritized renewable energy sources and sought to expand its share in its overall power development plan for the period 2017 to 2037. The projection is that by the year 2037, renewable energy sources will provide just over 60% of the installed power capacity in the country. Kenya adopted the Energy Act No. 1 of 2019 (the Energy Act) to, among other objectives, promote the generation of renewable energy in Kenya. The Energy Act mandates the relevant agencies to publish and review energy plans in respect of renewable energy to ensure delivery of reliable energy services and to, at a minimum, cost and develop a conducive environment for the promotion of investments in energy infrastructure development. To promote energy investments, national and county government are required to facilitate the acquisition of land for energy infrastructure development (https://cms.law/en/int/expert-guides/cms-expert-guide-to-renewable-energy/kenya).

The Energy Act establishes the Energy and Petroleum Regulatory Authority (EPRA) whose function is to regulate production, conversion, distribution, supply, marketing and use of renewable energy; collect and maintain energy data; ensure, in collaboration with the Kenya Bureau of Standards, that only energy-efficient and cost-effective appliances and equipment are imported into the country; and co-ordinate the development and implementation of a national energy efficiency and conservation action plan

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(https://cms.law/en/int/expert-guides/cms-expert-guide-to-renewable-energy/kenya).

Kenya's renewable electricity grid is at 90 per cent. According to the African Development Bank, Africa's energy financing gap as of May 2022 is $24.5 billion (Sh2.96 trillion) annually. The Electricity Sector Association of Kenya (ESAK) has unveiled key measures in enabling Kenya to achieve 100 per cent renewable energy (RE) by 2030. This is even as it reaffirms its commitment to the global climate agenda. The recent Energy statistics report by the Energy and Petroleum Regulatory Authority (EPRA) shows that Kenya has promising potential for power generation from renewable energy sources. Following a least-cost approach, the government has prioritized the development of geothermal and wind energy plants as well as solar-fed mini-grids for rural electrification.

3. Energy Village Roadmap

3.1. SWOT analysis

A SWOT analysis was carried out to map strengths, weaknesses, opportunities and threats related to the implementation of energy villages in Africa. The analysis shows that there are several factors, like huge potential for renewable energy, supporting the energy village concept, and implementing the concept could bring electricity available for people in many rural areas. However, there are also gaps e.g. in financing and infrastructure, and knowledge sharing and capability building are needed. The results or the SWOT analysis are shown in Table 3.

Table 3: The SWOT analysis.

S- Strengths	**W-Weaknesses**
- Untapped renewable energy potential (solar, biomasses, wind, geothermal) in rural areas and	- Financial constrains such as bank loans and insurances for the implementation of EV

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e.g. in Uganda contextually in Refugee Camps - Local interest for energy village concept - Support from the implementing partners in the refugee settlements that will spur easy adaptation of the new energy technologies - Mindset changes of the communities (e.g. enough sensitization was already done in the refugee camps) - Willingness and support from government regarding RE uptake - Developed and easily adaptable technology	- High Initial Costs (e.g. wind energy) - Lack of Infrastructure in many areas - Knowledge gap of the locals about renewable energy - Limited Technical Expertise - Tarif for to sale off-grid electricity from private sector - Implementation is slow due to systemic issues
O- Opportunities - Securing energy needs e.g. overcome electricity energy shortage - Improvement of the livelihoods and reduction of suffering in the rural areas of the country - Creating jobs, business and income for locals (and asylum seekers) - Holistic growth and development will be realized - Education and Training - Technological Advancements - Energy is a key enable for development in industry, as well as society.	**T-Threats** - Attitudes and stereotypes in the rural setting - Low disposable income in the rural and humanitarian settings in the country - Security situation in the rural areas of the country at times is still volatile - Lack of accountability in the implementation of RE projects threatens their success - Data availability, knowledge and willingness to provide data - Cost of new renewable energy technologies

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3.2. Roadmap

Developing a roadmap for an energy village involves a series of structured steps to ensure successful implementation and sustainability. The process begins with a comprehensive assessment of the community's energy needs and resources, identifying suitable renewable energy sources and potential installation sites. Engaging with residents, local leaders, and stakeholders is crucial for gathering input, building support, and fostering collaboration.

The next step is selecting and planning the appropriate technologies, including renewable energy generation systems, energy storage solutions, and smart grid and off-grid infrastructure. This involves creating a detailed implementation plan that outlines the deployment strategy, timeline, and budget. Once the planning phase is complete, the roadmap moves to infrastructure deployment. This includes the installation of renewable energy systems and energy storage solutions, ensuring proper setup, testing, and commissioning. It is also important to implement energy efficiency measures in buildings and infrastructure to reduce overall energy consumption.

Community engagement and education initiatives are vital to raise awareness, encourage participation, and ensure that residents have a good understanding about the benefits and operations of the energy village. Continuous monitoring and evaluation are necessary to track performance, gather feedback, and identify areas for improvement. Adapting and optimizing the system based on collected data, technological advancements, and a changing community need ensures that the energy village remains effective and resilient. Advocating for supportive policies and regulations at various governmental levels can create a favourable environment for scaling up and replicating the energy village model in other communities, contributing to broader sustainable development goals.

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4. Recommendations

A part of this deliverable was to highlight some elements that will be useful for the valorisation of the LEAP-RE experience into WP5 Long-term perspective and WP6 Building the Partnership. WP5 aims to develop the long-term perspective for the AU-EU partnership in RE STI. WP6 aims to address the practical steps towards the long-term goal of LEAP-RE, which is to build a lasting AU-EU partnership in R&I for renewable energies. These recommendations are based on WP14 experiences as well as the SWOT analysis and the Roadmap presented in the Chapter 3, and they aim for the successful sustainable development in Africa by addressing the energy challenges tasks defined in the SDG Agenda.

It is important to note that by implementing an energy village in rural area of Africa, we contribute to the different aspects: we bring electricity available to local people, and we support the use of renewable energy. As we note from the policies in different countries presented in the Chapter 2, there is in a general level political need and support for both of these. However, in order to increase access to clean and sustainable energy, the policies and actions must be based on accurate and correct data. For instance, the rural energy profile for the country still lacks a reliable database that could be used to guide in policy formulation. This is one point in which long-term EU-AU cooperation could assist.

From the results of WP14 we know that the potential for renewable energy in many areas is even more than the demand. However, as stated in the Roadmap for Energy Village, there is a long way from potential to actual implementation and utilization of an energy village. It requires a lot of expertise in technical matters not to mention the interaction and capacity building with the local people. Some sort of intermediate or knowledge broker will be needed. An African wide network of EV experts proposed by WP14 could help in this as well as allowing private players in the generation and distribution of electricity especially in the rural settings. However, no

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matter how this is organized, it will require long-term work and commitment.

Another asset essential to the implementation of an energy village is funding. The long-term AU-EU partnership could be used for creating a funding system that actually brings the implementation of an energy village available. This would require the participation of various high-level stakeholders like governments, the International Bank for Reconstruction and Development, national banks.

In order to harness the full potential and to bring the benefits of the energy provided by an Energy Village for the local people, the access to energy should be coordinated to other development plans. This way the productive use of the available energy sources for the overall socio-economic transformation of the societies can be ensured. No doubt, there is also need for education and capability building as well as a need to facilitate a sense of ownership by communities so that they play active roles in the sustainability of RE projects.

EU and European organizations have a lot to an offer for reaching the SDA objectives in Africa, but everything has to be done in cooperation. It is also clear that the change takes time from a trust building with local people in villages to actual prosperous Energy Villages. The change requires long-term AU-EU cooperation.

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5. Conclusions

Analysis of prevailing energy policies in the partner countries of Uganda, Kenya, Botswana and Ethiopia showed great strides being made in the promotion of sustainable development in communities through the utilization of reliable renewable energy sources. This has seen great improvement in the livelihoods of both urban and rural communities hence inching the countries closer to the realization of the Sustainable Development Goals.

SWOT analysis showed a number of opportunities which among others include the creation of job and education opportunities, the holistic development of the communities and improvement in livelihoods. However, there were quite a number of challenges such as low disposable income especially for the rural communities. This will require subsidies of some kind to make the solutions affordable for such rural and humanitarian communities.

We conclude that a long-term AU-EU partnership can be used for supporting the strengths for establishing energy villages across the African and thus harnessing the opportunities for local people. It can also be used for overcoming the weaknesses and avoiding the threats related to greater the utilization of renewable energy.

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