



KISUMU COUNTY

COLLABORATIVE ROADMAP DEVELOPMENT TOWARDS 100% RENEWABLES

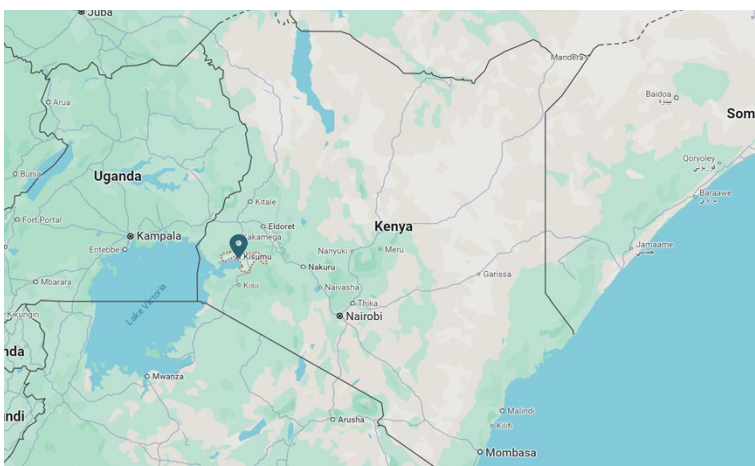


Figure 1: Location of Kisumu County, Kenya
(Source: Initial Energy Status Report, Kisumu County, Kenya, 2020)

Kisumu County, Kenya: Facts and figures

Population

1.15 million residents

Total area

2,086 km²

GHG emissions

61 million tCO₂eq

Total energy consumption

~192.6 TWh (as of 2021)

Introduction

Kisumu County was selected as the “deep-dive” city in Kenya for the 100% Renewables Cities and Regions Roadmap (100% RE) project in 2019. Through the project, ICLEI worked closely with the County Government of Kisumu (CGK) to lay out its roadmap towards a fully 100% renewable energy mix across all sectors by 2050. Three sectors—electricity, transport and cooking—were prioritized in Kisumu’s 100% Renewables Roadmap, following extensive efforts related to securing political commitment, data collection, energy modelling, and capacity building. Kisumu and the other networking counties of the project—Nakuru and Mombasa—were well-placed to showcase the potential of local and regional governments in driving the renewable energy transition given Kenya’s existing commitment to renewable energy.

Kenya aims to become a newly industrialised middle-income country by 2030 as outlined in its Vision 2030 development plan. Development challenges persist, with 45% of the population living below the poverty line, and access to electricity remains a key concern. Around 76% of the population had access to electricity in 2022—this corresponded to electricity access rates of 98% and 65.6% for urban and rural populations respectively ([Tracking SDG 7, 2022](#)). The rate of access to clean cooking fuels and technologies is around 30% nationwide ([World Bank, 2023](#)). Still, renewable energy (RE) sources currently make up almost 90% of Kenya’s electricity generation, with geothermal, hydro, and wind energy being the primary contributors ([IEA, n.d.-a](#)).

In order to advance its RE contributions, Kenya is guided by a number of policies—the **Kenya Vision 2030** serves as the country’s long-term development blueprint, emphasizing the critical role of energy in achieving industrialization and middle-income status by 2030, with a focus on increasing electricity generation

from renewable sources such as geothermal, wind, and solar. This vision is supported by the **National Energy Policy 2018**, which provides a framework for the development and efficient utilization of energy resources, setting clear targets for expanding renewable energy generation. Additionally, **Kenya’s National Electrification Strategy (KNES) 2018** and the Feed-in-Tariffs policy incentivize renewable energy projects, particularly in off-grid and remote areas. Kenya’s commitment to climate action is further reinforced by the **Climate Action Act 2016** and the **National Climate Change Action Plan (NCCAP) 2023-2027**, which emphasize low-carbon development and renewable energy expansion as key strategies for reducing greenhouse gas emissions. Regionally, Kenya is aligned with the **African Union Agenda 2063** and the **Africa Renewable Energy Initiative (AREI)**, both of which prioritize increased RE deployment across the continent. Internationally, under the Paris Agreement, Kenya has pledged to cut greenhouse gas (GHG) emissions by 30% by 2030.

Kenya’s devolved governance system, along with the authority granted to county governments by the Energy Act 2019, empowers counties to take a more active role in shaping energy policies and frameworks, as Kisumu County has done. Kisumu, along with Mombasa and Nakuru, is one of the larger cities in Kenya, after Nairobi. . Kisumu’s energy challenges are mostly linked to a lack of access to modern, clean, and affordable energy sources, and the County has made significant progress in tackling these. Although slightly below the national average, the county’s electrification rate stood at approximately 52.6% in 2019. Access to clean cooking solutions, including LPG, reached 23% as of 2024 ([ICLEI, 2024a](#)). Challenges remain, particularly in the transport sector, where the use of fossil fuels is predominant. Thus, any energy plans and

strategies Kisumu adopts would have to tackle these challenges to be effective and sustainable.

Kisumu receives electricity from Kenya's national grid which is primarily powered by geothermal (41%) and hydro (30%) (IEA, n.d.-b). In Kisumu County, the primary local RE sources for electricity generation are hydro-power and biomass. The majority of power plants in the region are operated by KenGen, which runs both hydroelectric and thermal generation facilities. Moreover, three sugar factories in the county generate their own electricity using biomass (bagasse), with a combined installed capacity of 21 MW. In 2018, Kisumu had an installed capacity of 81 MW from hydro, 30 MW from gas, and 21 MW from biogas, collectively generating 9,517 GWh, 65.5 GWh, and significant contributions from biogas, respectively (ICLEI, 2024a).

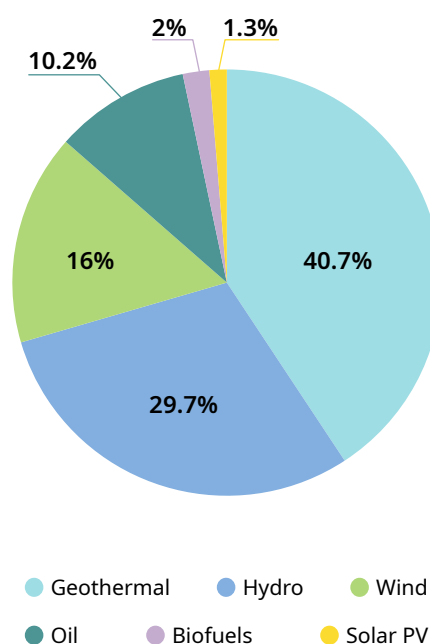
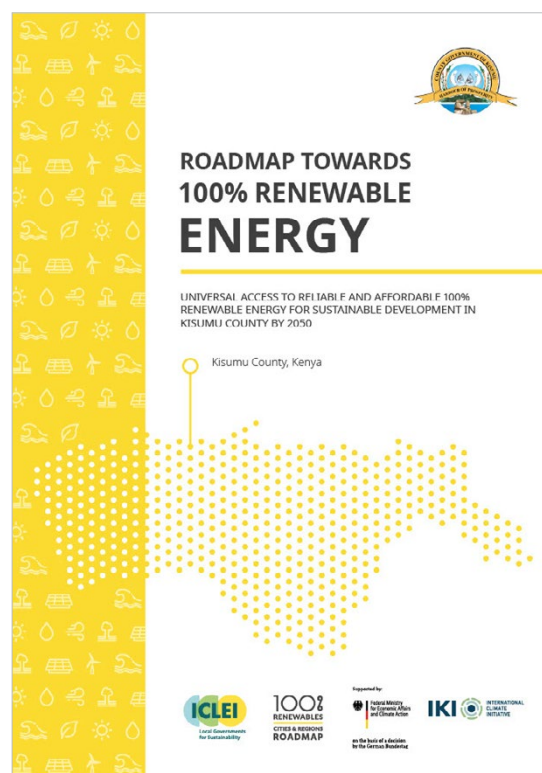


Figure 2: Electricity generation in Kenya (Source: IEA, n.d.-b)

Kisumu’s journey to 100% renewables

In 2019, Kisumu demonstrated its commitment to advancing the sustainable energy transition for its community by joining the 100% Renewables Cities and Regions Roadmap project as a deep-dive city. The project intended to develop a roadmap for Kisumu County to reach 100% renewable energy use by 2050, across all energy-consuming sectors. A roadmap is a strategic framework that logically deconstructs the government’s long-term vision into key projects and milestones essential for policy implementation (Kerr, Phaal, & Probert, 2013). Kisumu’s 100% Renewables Roadmap (“Roadmap”) was designed to serve as a comprehensive plan guiding the County Government for a transition to a 100% renewable energy system by 2050. The Roadmap outlines the pathways, critical steps, targets, and actions needed to achieve this ambitious goal, in line with the vision of Kisumu County.



The Roadmap development process involved several steps, as detailed in the 100% Renewables Cities and Regions Roadmap Framework shown in Figure 3. While the

Framework is meant as general guidance, the sections below will detail the steps that were unique to Kisumu and what challenges were encountered along the way.

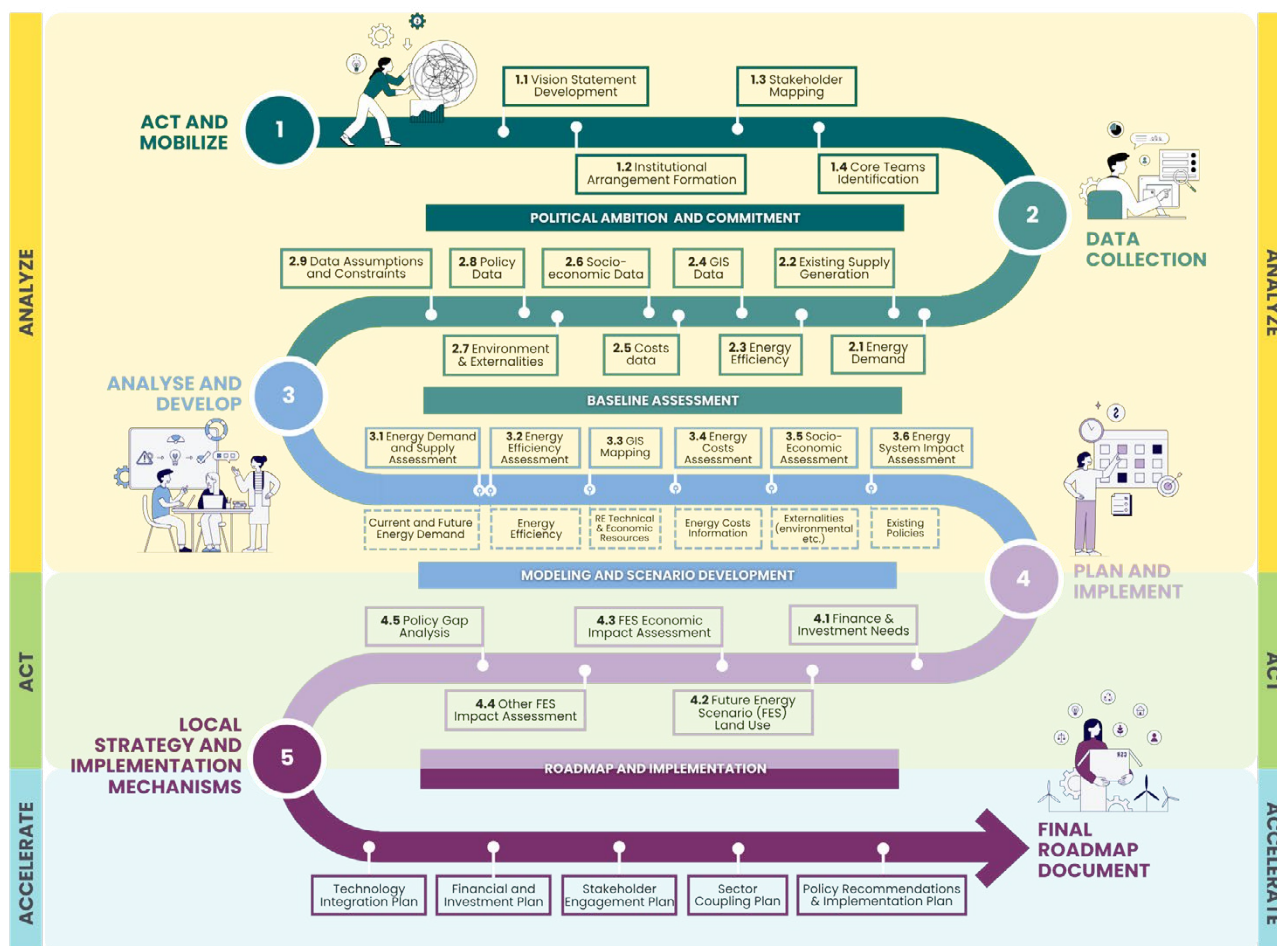


Figure 3: The 100% Renewables Cities and Regions Roadmap Framework (Source: ICLEI, 2021)

1. **Political ambition and commitment** - where local and regional governments (LRGs) lay out the initial vision, commitment, and requisite resources and teams for planning the local strategy;
2. **Baseline assessment** - where the LRG's baseline socio-economic, energy and environmental data is collected and identified for future use;
3. **Modeling and scenario development** - where various energy system scenarios are developed based on the gathered/ simulated data, constraints, and assumptions, providing potential pathways and timelines towards 100% renewables;
4. **Roadmap development** - where a strategy is mapped out based on the previous analysis in order to achieve a set goal. The roadmap answers the 'how' of undertaking a sustainable energy transition, narrowing in on priority sectors and implementation mechanisms. This roadmap can be aligned with other relevant development objectives and plans in order to mainstream an evolving energy system.

Political ambition and commitment

The initial step in initiating a local sustainable energy transition is to secure the necessary **political ambition** for its implementation (ICLEI, 2021). Without effective policy guidance, it is unlikely that resources (financial, technical, etc.) will be allocated in the most efficient or inclusive manner, potentially resulting in unintended negative outcomes. This can be undertaken through the formation of a collective vision statement, identifying concerned institutional arrangements and key stakeholders, the formulation of core teams, and a definition of the 100% RE scope. Kisumu undertook these steps as detailed below.

Vision statement development

A vision statement outlines the local government's priorities for the renewable energy transition. The first step in generating a vision statement is identifying who will be involved in its development and how to include a variety of stakeholder perspectives. The engagement of all relevant stakeholder groups at this stage is crucial to help define a collective vision and ensure buy-in. Therefore, a 'visioning workshop' was held in 2020 in Kisumu, which led to its collective vision for a 100% renewable energy future by 2050. Participants brainstormed what is feasible and viable for the county to accomplish, and what steps could be taken to improve economic and sustainability prospects for future generations.

During the process, each group discussed the initiatives to be implemented at 10-year intervals, starting with 2050, followed by 2040, and finally 2030. Participants voted for the statement they deemed most ideal, selecting "Towards 100% Renewable Energy for Sustainable Development by 2050." This statement was further refined, leading to the final vision statement: **"To achieve universal access to reliable and affordable 100% RE for sustainable development in Kisumu County by 2050."**

Institutional arrangement formation, stakeholder mapping and core team identification

Relevant teams and groups were formed at the national and local levels in order to ensure smooth implementation of the project and its objectives as well as to secure buy-in and feedback. A local Project Implementation Team (PIT) was formed in Kisumu. This team featured representatives from county departments such as Energy, Infrastructure, Transport, Public Works, Environment, Climate change, Water, Gender, and Communications and was involved in day-to-day project activities. A National Project Advisory Group (NPAG) was also created to provide strategic direction and feedback to the project. It included representatives from the Kenyan Ministry of Energy and Petroleum, Energy and Petroleum Regulatory Authority (EPRA), Rural Electrification and Renewable Energy Corporation (REREC), KenyaPower, Treasury, and the Council of Governors (CoG). The Ministry of Energy and Petroleum led the NPAG and appointed two focal persons for quick correspondence. Involving relevant stakeholders and identifying their potential roles at the early stages of roadmap development can help with future implementation efforts. There were regular interactions with the PIT and NPAG, which meant that project activities saw buy-in from these stakeholders.



Engaging healthcare stakeholders in Kisumu

Data collection and analysis

The next step of Roadmap development involved gathering energy-related data. In Kisumu, the majority of the data collected related to the following parameters (ICLEI, 2021):

- **Energy demand and supply:** Identifying current energy supply and demand patterns is crucial for scenario formulation, and provides a baseline for any future energy transition. This includes data on energy-consuming sectors, fuel types, losses, etc. Possible future energy supply and demand can be estimated using these baselines.
- **Geographical information systems (GIS) data:** GIS mapping provides information about suitable locations for RE plants and helps quantify the potential of energy resources that can be harnessed. This is important to identify the local renewable energy potential, as well as to determine what share of energy demand can be met with local sources, as well as how many new RE developments must be and can be constructed.
- **Energy costs:** Collecting cost data connects the energy transition with financing, investment options, and the economic

impact of the transition. Cost data can help determine the viability of a certain fuel type or its alternatives, as ensuring the affordability and socio-economic impacts of the transition is crucial for its success.

- **Socio-economic data:** Socio-economic data is important to assess the viability of a transition, as well as to estimate future patterns of growth and their energy requirements. These include population growth rate, income levels, etc.
- **Environment and externalities:** This involves quantifying the environmental impacts of the county's current energy consumption i.e. CO₂ emissions. Other externalities may encompass the impact of air pollution, water consumption, land use change, etc.

Data collection is perhaps the most challenging aspect of roadmap development for local governments. While the CGK was able to supply what data they had, external experts had to be hired for some specialized datasets, such as GIS data. Where data was not available, proxies or synthesized data was used, although this comes with its own limitations.



Officials from the Kisumu County Government partaking in project activities

Energy systems modeling

Kisumu's energy system was modelled in order to form the basis of future roadmap development. This energy modeling was conducted by Fraunhofer ISE using the KomMod simulation software to explore whether a 100% renewable energy future is feasible by 2050 (ICLEI, 2022). Several parameters and boundary conditions related to the energy system were fed into the model. As an

output, it provided a cost-minimized scenario of the energy system, where demand and supply were optimized at an hourly temporal resolution over the period of one year (i.e. 2050 in this case). The following Figure 4 depicts what such an energy system could look like, with the sources of energy on the left, transformation processes in the middle, and final consumption on the right.

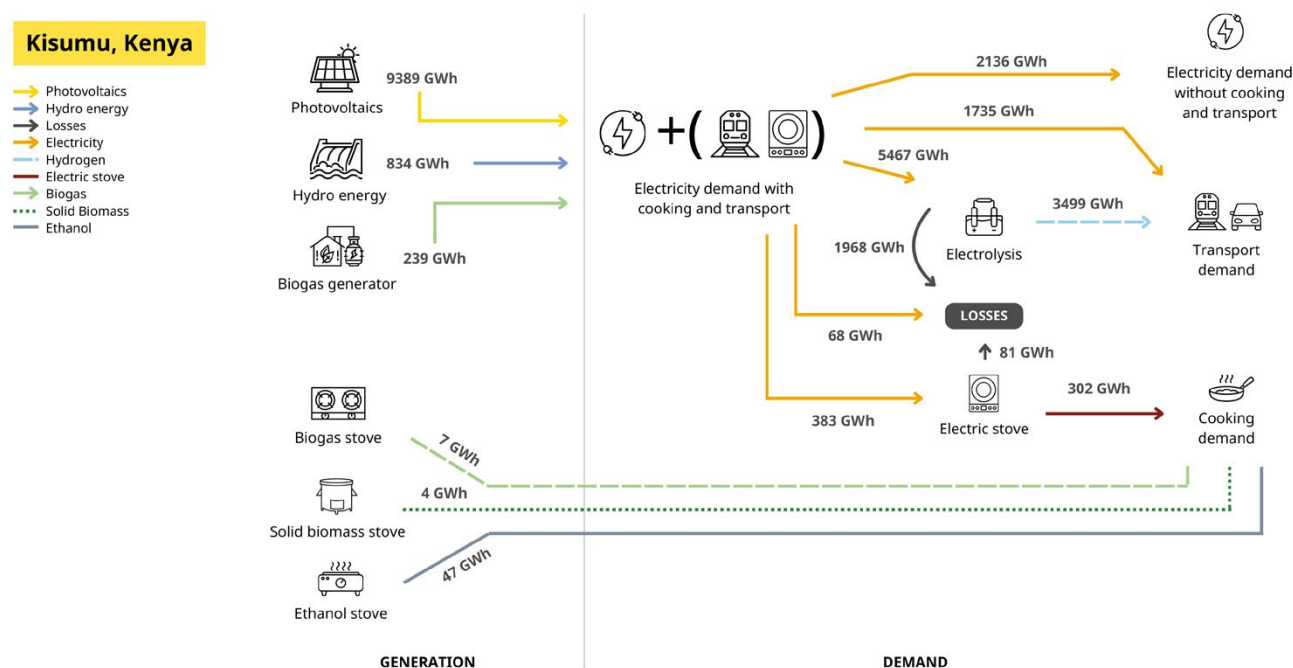


Figure 4: Energy flow diagram of Kisumu's 100% renewable energy system in 2050 (Source: 100% Renewables Roadmap for Kisumu County, Kenya)

Of the available local renewable energy sources in Kisumu, solar photovoltaics (PV) were identified as having the greatest potential, with bagasse, municipal waste, hydropower, and biogas from manure and crops also showing significant promise in a potential 100% renewables future. Other renewable energy sources have only limited potential. Wind power is not viable due to insufficient wind speeds in the area. Although geothermal energy is highly promising in other regions of Kenya and is a priority for the national government, it holds no potential in Kisumu (ICLEI, 2022).

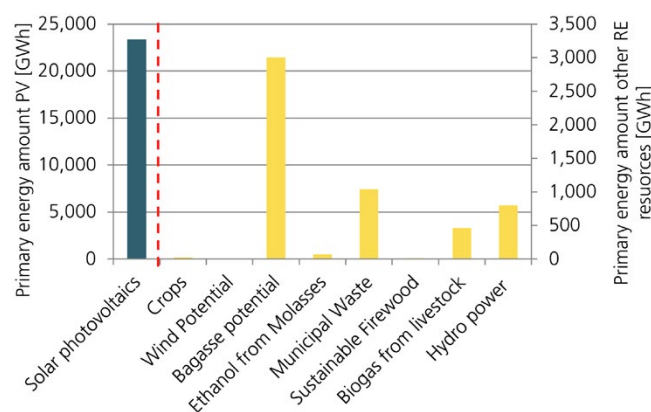


Figure 5: RE potentials for each technology in Kisumu (Source: ICLEI, 2024b, p.19, figure 5)

Furthermore, seven different 100% RE scenarios were modeled by adjusting variables such as energy demand, biogas fuel prices, fixed usage of various RE technologies (i.e., utilizing full available potential), and heating demand. Additionally, a business-as-usual (BAU) scenario was modeled for comparison of costs and CO₂ emissions. Based on consensus from the PIT, two leading

scenarios were chosen as shown in the Table 1 below. The least-cost option featured a mix of technologies that would minimize total system costs within the specified constraints. The hydropower fixed scenario involved fully utilizing the available hydropower potential, which is estimated to be 0.2% more expensive than the least-cost option, making it a comparable alternative (ICLEI, 2024b).

Table 1. Overview of leading 100% RE scenarios for Kisumu (Source: ICLEI, 2024b, p.22, table 4)

Technology	Hydropower fixed scenario		Least-cost scenario	
	% share	Generation capacity (GWh pa)	% share	Generation capacity (GWh pa)
Solar PV	90%	9,389 GWh pa	98%	10,397 GWh pa
Biogas	2%	223 GWh pa	2%	239 GWh pa
Hydro	8%	834 GWh pa	0%	0 GWh pa

This modeling exercises involved the close cooperation of the CGK, with multiple rounds of feedback in order to address data gaps and ultimately identify the two leading scenarios. This level of involvement allowed for granular insights, such as energy usage patterns, and the feasibility of certain approaches, that were incorporated into the modeling

results and interpretation. As is the case with any energy modeling, it laid out a potential pathway towards 100% renewable energy, offering insights into the sources available, a tentative timeline, and various other considerations, which needed to be further developed into actionable steps during the subsequent roadmap development process.

Drafting the Roadmap

The final stages involved defining the Roadmap itself. The final roadmap document involved a much more detailed investigation into the actions that can be implemented at the local level based on the findings of the modeling exercise, taking into account existing policies, local government powers and authorities, sources of financing, etc. In order to provide a cohesive, ambitious, yet achievable plan, Kisumu chose to prioritize certain sectors for urgent action—electricity (including local generation and energy efficiency), transportation (to shift

away from fossil fuels), and clean cooking (to reduce to a large extent the dependence on traditional biomass for cooking).

Corresponding actions under each priority sector were identified through multiple rounds of feedback, workshops to gather inputs, and other exercises. All the actions laid out in Kisumu’s Roadmap were guided by certain key principles that were developed in collaboration with the County Government of Kisumu (ICLEI, 2024b):

- Uplifting the social and economic well-being of Kisumu County residents
- Supporting industrialization and economic growth through sustainable energy resources
- Ensuring environmental protection and advancing climate action
- Emphasizing co-development, inclusive participation, and strong stakeholder engagement
- Adopting process-oriented and holistic approaches to energy systems
- Basing decisions on scientific evidence for climate protection
- Demonstrating city leadership and making bold, forward-thinking decisions

The overall targets for each of the priority sectors are listed in Table 2 below. Each of these targets were further broken down into intermediate targets.



Decentralized solar PV in Kisumu

Table 2. Overview of sector-specific targets in Kisumu's 100% RE Roadmap

Sector Targets		
Electricity supply and access target	Transport target	Clean cooking target
<ul style="list-style-type: none"> • By 2050, 100% of electricity generated in Kisumu County should be from RE sources, from solar PV, hydropower, biomass (waste-to-energy e.g., from water hyacinth, bagasse, etc.), including enablers such as green hydrogen. • All stationary energy demand is met through RE technologies and enablers by 2050 	<p>By 2050, eliminate the use of fossil fuels in the road transport sector of Kisumu County through the use of non-motorised transport (NMT), electric vehicles and green hydrogen technology</p>	<p>By 2028, achieve 100% access to clean cooking technologies in Kisumu County by using electric stoves, efficient biogas and ethanol stoves, briquettes, solar cookers, and energy-saving stoves for the residential and commercial sectors and other institutions</p>

Under each priority sector, a number of actions and their implementation mechanisms were identified. For each action, the benefits, success factors, existing policies, potential GHG emissions and energy

reduction expected, timelines, potential funding sources, as well as roles and responsibilities for various stakeholders were detailed, and an implementation strategy was laid out. For example, one action identified under

electrification involved increasing the uptake of energy-efficient lighting in public areas. This aligned with Kisumu’s existing mobility and energy plans. To implement such a measure, Kisumu would need to map and prioritize certain areas in the county for urgent action,

define or update procurement guidelines, and collaborate with the private sector where possible. The draft Roadmap was shared with the county’s PIT, as well as the NPAG for multiple rounds of inputs and feedback and the final validation of the Roadmap.

Setting the stage for implementation

Although evidence- and data-based planning is critical for implementing the local renewable energy transition, it is only part of the picture. In order to ensure that the actions laid out in the Roadmap have the best chance of being implemented on the ground, Kisumu also participated in a number of supporting activities, such as capacity building, stakeholder engagement, and bankable project development.

Capacity building activities

As part of the 100% Renewables Cities and Regions Roadmap project, capacity building activities were conducted to support the final implementation of the Roadmap. In close cooperation with the County Government of Kisumu, a capacity needs assessment was carried out to determine key training topics. Trainings were most appreciated when they were in-depth, in-person, and tailored to Kisumu’s local context. Several areas were identified to complement CGK’s existing competencies, including:

- Renewable energy and climate finance, as well as emerging technologies and trends;
- E-mobility and the role of RE in transport;
- Energy efficiency, particularly in buildings;
- Mainstreaming gender and justice in RE action planning;
- Clean cooking technologies and approaches;
- Emerging technologies such as green hydrogen, as well as energy storage.



Capacity building on clean cooking held in Kisumu

Innovative stakeholder engagement

Given the complexity of the sustainable energy transition and the need for close cooperation among several stakeholders, the 100% RE project deployed a unique stakeholder engagement tool—serious games. ‘Serious gaming’ is a methodology that focuses on learning through gaming and simulation techniques. The Sustainable Energy Transition Strategy (SETS) role-playing

game was used to provide inputs and gather feedback on Kisumu’s Roadmap, bringing together various stakeholders including county officials across various departments. By incorporating elements of play and interactivity, it can help generate innovative insights and simulate the potential effects of planning decisions. Participants assume roles different from their daily ones, allowing them to consider an issue from a different viewpoint than one they are used to.



Kisumu County officials participating in the SETS serious game

Bankable project development

In order to kick-start implementation efforts, Kisumu was supported in developing a bankable project. Officials from the CGK were involved from the start, providing feedback and the necessary approvals and insights. The initial stages involved identifying projects to support the transition, including those outlined in county development plans and documents such as the

Sustainable Energy Access and Climate Action Plan (SEACAP) for Kisumu. Thereafter through a series of bilateral meetings, these projects were prioritised based on criteria such as described in the table below, and a final project was selected. It was also a learning exercise for everyone involved about how such projects and proposals are developed.

Table 3. Evaluation criteria for the choice of bankable project for Kisumu County

Impact		Project details		Funding potential	
Expected Results	Outcomes relevant to renewable energy (kW of clean energy generated) and energy efficiency (kW saved)	Political buy-in	Alignment with country development plan (CDP)	Sustainability of the project	Underlying business model to the projects (revenues to cover the OPEX)
Environmental benefits	Estimated benefits (potential to reduce GHG emissions)	Capacity to support	Capacity at government level to support the project	Available data/ technology	Technology used (lifetime, performance, productivity, etc.)
Social benefits	Number of beneficiaries	Implementation readiness	Identified partners for the project	Available data/ financial assumptions	Financial assumptions (costs, revenues)
Financial benefits	Potential to reduce municipal energy bills	Technology availability	Availability of the technology locally/ local partners to implement the project/ local skills	Available data/ studies	Studies available

Ultimately, Kisumu's bankable project aims to integrate renewable energy into and improve the energy efficiency of 8 county hospitals, thus highlighting the ability of renewables and energy

efficiency measures to serve cross-cutting development goals such as improved healthcare, more resilient infrastructure and reduced carbon emissions associated with energy use.

Lessons learnt

Kisumu County's journey showcases its high ambition at every step. Aiming for 100% renewable energy use is not easy, but it is worthwhile, and Kisumu has shown a commitment to making sure such a transition affects the lives of as many people as possible for the better. Renewables have great potential in addressing the energy-related challenges faced by Kisumu's residents. Implementation is of course challenging, necessitating cooperation with multiple partners and stakeholders. Kisumu's example can serve as an inspiration for other local and regional governments intending to undertake this journey, and the following 'lessons learnt' can provide further insight into some good practices.

Improve vertical and horizontal cooperation

Working with national government ministries and agencies is important for the success of any local and regional efforts. National government stakeholders can provide strategic guidance and share information about ongoing projects and activities in their ministries that could be beneficial to the city/region. However, it is to be foreseen that administrative and bureaucratic procedures can often delay certain processes, especially when working across multiple levels of government. For example in Kenya, one hurdle in securing financing for county-level projects is that the national government must guarantee these funds. This requirement complicates obtaining direct funding from international sources for counties. Policy alignment and effective resource distribution is critical as in Kenya, energy is a shared mandate between the national government and counties, and the county needs to implement national policies and standards. Establishing channels of communication can lead to more regular and targeted feedback to tackle such issues and barriers. Moreover, peer cities and regions may also have a lot to contribute. Establishing

a strong working relationship with the relevant cities' association in the country is also beneficial—in the case of Kisumu county, this was the Council of Governors and the CoG had a dedicated Energy team which was the focal point for the 100%RE project. Neighboring counties may also have more established energy policies/strategies/initiatives that can serve as relevant examples. For example, the 100% RE project's networking counties, Nakuru and Mombasa, had a lot of knowledge to share with the deep-dive counties. It is therefore beneficial to involve them in capacity building workshops to promote exchanges and enrich the sessions.

Actively promote diversity and inclusivity in planning efforts

Gender and other disparities within the groups that drive decision-making, including in a process such as roadmap development, are common and unfortunate. Active efforts should be made to ensure vulnerable groups receive representation in some capacity, as a lack of gender or other parities is often a consequence of broader systemic challenges, resulting in underrepresentation in key decision-making roles. Such underrepresentation can deprive planning efforts of diverse perspectives and experiences.

Create robust project teams

Changes in leadership are common at the local and regional level, and can disrupt project or planning activities. In Kisumu, the County Government was able to identify key officials and representatives to be incorporated in the project implementation team (PIT) from the start. Having a strong PIT team can be critical in order to minimize disruption to project activities in the case of political or leadership changes. A stable PIT with a diversity of members can keep the project going until new leadership is appointed.

Invest in data capabilities

Accessing accurate and up-to-date information regarding energy access and the potential for RE development in Kisumu County was another challenge, one that is not unique to Kisumu and faced by many other cities and regions. Many of the existing resources were outdated, lacking the most recent developments and trends necessary for informed decision-making. Moreover, some relevant information was available but not openly accessible to the public, often confined to internal reports or held by specific agencies without being published online. This limited access to current and comprehensive data impeded effective planning and decision-making for the roadmap development. Cities and regions can address these by adopting policies of data transparency and investing in data capabilities and literacy, as these can have outsize impact on overall government functioning. They should leverage existing knowledge, expertise, and resources within their governments as well as national government agencies to get data that might not be publicly available to help fill data gaps.

Partnerships are critical

There are often several projects and organizations working towards similar goals in one area. Collaboration with other organizations implementing similar projects can help improve efficiency, share resources and expertise, and save costs. For example in Kisumu, many trainings were organized in collaboration with other partners to streamline the offerings. Other partnerships included Fraunhofer ISE to conduct the energy modeling, consultants for data collection, financial institutions international development organisations deploying energy- and climate-related projects in the county, etc.

Every 100% renewables journey is unique

Policy localization is needed to fit any city or region's unique context and resources. No two cities or regions would have the same journey, however there are enough core commonalities and experiences that can be shared and learned from. For example, there are limitations in exploring local or home-grown technology options, and there are not enough viable projects that are ready for investment. These challenges are further compounded by the complexities of project preparation, procurement, and the public-private partnership development process, particularly in the absence of enabling national-level policy frameworks.

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The 100% Renewables Cities and Regions Roadmap project facilitates the energy transition by raising local awareness on renewable energy sources, showcasing how local and national governments can create coordinated enabling frameworks and policies, exploring access to public and private sector finance, and building local renewable energy projects to address electricity, heating and cooling.

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ICLEI – Local Governments for Sustainability is a global network of more than 2500 local and regional governments committed to sustainable urban development. Active in 125+ countries, we influence sustainability policy and drive local action for low emission, nature-based, equitable, resilient and circular development. Our Members and team of experts work together through peer exchange, partnerships and capacity building to create systemic change for urban sustainability.

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