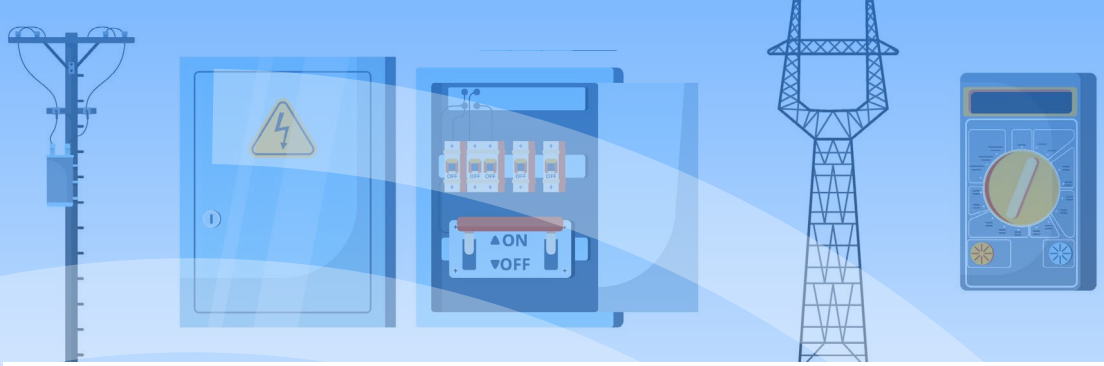

Climate Compatible Growth

COP27 POLICY BRIEF SERIES

A data driven approach to integrated, inclusive sub-national energy planning in Kenya

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Summary

Achievement of SDG7 requires extensive collaboration between national and subnational governments and the private sector. In 2020, Kenya's electricity access was 71% (urban 94% and rural 63%) while only 20% of the population had access to clean cooking (urban 44% and rural 5%). A better understanding of end-users' needs is needed to design viable electrification and clean cooking solutions. These vary from one location to another depending on several socio-economic characteristics, energy resource availability, and proximity to power infrastructure. However, such geospatial data are often either scarce, fragmented, inconsistent, or exist only at national levels. This hampers their use for integrated energy planning at subnational levels. This policy brief explains how we addressed some of the data challenges while developing a local energy plan for Narok County, Kenya. Through integration of traditional and digital tools, we collected granular data which provided insights and inputs for customizing the Energy Access Explorer for Narok County.

Key Policy Recommendations

- National and sub-national governments, and energy planners could use and strengthen their capacity in geospatial data and analytical tools in order to support integrated energy planning.
- County Governments and Ministry of Energy should work with stakeholders to adopt a well-managed, open source, and dynamic information system. This will help address data collection, data sharing, and data governance challenges related to the development and maintenance of a dynamic geospatial database and analytical platform.
- Data providers need to optimize data collection for better understanding aspects of demand and affordability.
- County Governments should enhance community and cross departmental engagement to inform prioritization of locally applicable solutions.

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Introduction

Universal energy access is one of the complex problems of our time. Globally 733 million people do not have access to electricity and 2.4 billion lack access to clean cooking facilities in 2020. The majority of these people reside in Sub-Saharan Africa with 533 million (48% of the population) lacking access to electricity and 923 million people (83% of the population) lacking access to clean cooking facilities [1]. In 2020, Kenya's electricity access was 71% (urban 94% and rural 63%) while only 20% of the population had access to clean cooking (urban 44% and rural 5%) [2].

Access to reliable energy is an enabler for the delivery of social services such as health and education – among others. It also enhances livelihood opportunities and enables access to basic needs such as food. Towards this end, SDG 7 highlights the importance of universal access to affordable, reliable, sustainable, and modern energy for widespread sustainable economic development [3].

Realization of SDG7 requires adoption of both top-down and bottom-up approaches to energy planning, involving the roles of both national and sub-national governments. [4] This is essential, given the rapid decentralizing nature of the modern energy system [5].

The Kenyan Energy Act (2019) [6] provided two levels of energy planning: counties (sub-national governments) are first to develop energy plans specific to their local contexts. The national government, through the Ministry of Energy, then amalgamates these plans and develops them into an Integrated National Energy Plan. If done well, the county energy plans can help enhance access to clean, reliable, just, and affordable energy to the millions of Kenyans still living without access to services and clean cooking solutions [7]. Only 8 out of the 47 counties have managed to develop their plans to date. Often highlighted significant barriers include limited technical capacity and resource constraints, in addition to a lack of data relevant to remote and underserved populations. [8–9] A better understanding of end-user needs is important in designing viable electrification and clean cooking solutions. These vary from one location to another depending on several socio-economic and demographic characteristics, energy resource availability, and proximity to functional power infrastructure, among other critical information on environment, climate, and access to finance. However, such geospatial data are often either scarce, fragmented, inconsistent, [11] or exist only at national level, thus hampering their use for integrated energy planning at subnational levels. In this brief, integrated energy planning is used to attempt to incorporate the geographic and subject areas excluded under traditional energy planning (e.g., institutional electrification, power for productive uses, and access to clean cooking) [12–13].

“However, such geospatial data are often either scarce, fragmented, inconsistent, or exist only at national level, thus hampering their use for integrated energy planning at subnational levels.”

This policy brief explains how we addressed some of the challenges of data gaps, using our project – the Narok County Energy Plan – as a case study.

Narok County is situated in Kenya along the Great Rift Valley. In 2019, the county had 238,115 conventional households. 90% of the population relied on solid fuels for cooking and less than 20% had access to electricity [14]. The low energy access rates informed the choice of Narok County

Methodology

Thanks to advances in geospatial technology, novel tools were used to collect granular data (KoBo Collect), identify high priority areas for energy access interventions (Energy Access Explorer), and estimate technology and investment outlooks for achieving electrification targets (Open Source Spatial Electrification Tool: OnSSET). KoBo Collect (**Figure 1**) is a mobile application for the KoBo Toolbox database, a computer-aided personal interviewing tool based on Open Data Kit. It can be installed on mobile devices and used in place of paper-based questionnaires. This improves the accuracy and efficiency of primary data collection, processing, and analysis. It can also be used to attach geographic coordinates to each data point collected. Energy Access Explorer was used to synthesize, harmonize, store, visualize, and analyze granular geospatial information on current or potential supply and demand for energy services. This could then identify high priority areas for expanding access to energy. Finally, OnSSET accounted for local technology costs, electricity consumption and affordability levels, and several location-based characteristics of settlements in Narok to estimate the electrification technology needs and the associated investment requirements to achieve universal electrification.

The data collection process started by building consensus on the minimum data needs. Coordination was enhanced by developing

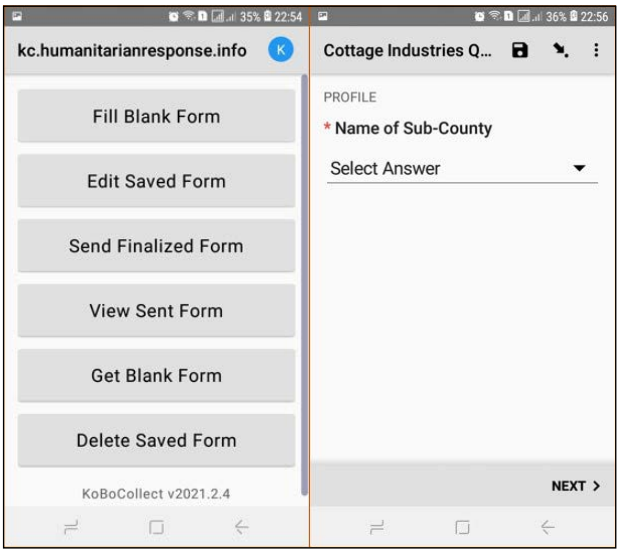

Figure 1: Interface of the Kobo Collect App

and sharing a comprehensive, dynamic data wish-list with the key stakeholders, including different departments from Narok county government, Kenya National Bureau of Statistics (KNBS), the state utility – Kenya Power – and the regulator, Energy and Petroleum Regulation Authority (EPRA). This was then followed by collection of data from different secondary sources including global, national, sub-national reports and databases available in the public domain. We then identified data gaps and filled them by conducting elaborate surveys (665 households, 58 education institutions, 27 health care facilities, 790 small and medium enterprises (SMEs), and 3 cottage industries) across the county focussing at the ward level (smallest administrative unit). Qualitative data was collected through key informant interviews and16 focus group discussions[1].

[1] Semi-structured key informant interviews were carried out with 6 county department officials, 2 cooperative society officials, 2 conservancy officials, and 3 energy practitioners. This was aimed at understanding county planning processes, plans and community/business energy needs and priorities. Focus group discussions applied the same approach but in a group set up, aimed at getting different perspectives from participants.

The surveys, used for quantitative data collection, were administered by use of the KoBo Collect Application installed on Android powered devices. This provided an efficient way of getting input data at increasing levels of granularity, covering households (rural and urban), institutions, and productive uses of energy (PUE) segments. Data quality checks were programmed in the questionnaires using skip logic to ensure only relevant questions were asked. For mapping purposes, each of the questionnaires featured a geographic Information system (GIS) prompt that collected the coordinates of households and premises interviewed.

The focus group discussions involved PUE segments as well as different gender and social inclusion groups. This added nuance to data collected by the other methods by getting local insights, which helped identify priority intervention projects and data related to people's willingness and ability to pay Quantitative data collection also included consumption data from general energy audits which were carried out in sampled major facilities in Narok County. Energy data loggers were installed in each facility for 2 weeks.

Figure 2: Visualization and analysis of sample data-sets using the energy access explorer including: population density, health and education facilities, solar potential (global horizontal irradiation), and electrical power transmission and distribution network.

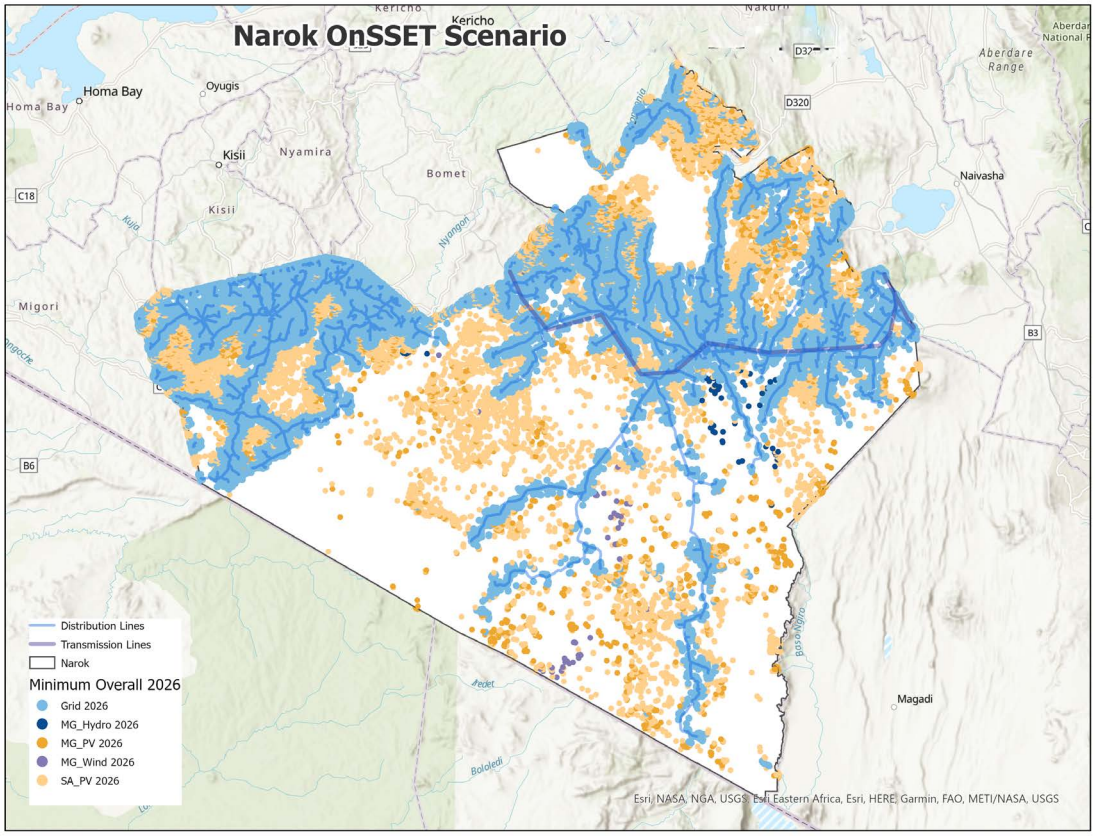

Figure 3: Map showing the least cost electrification technology options for different settlements using one of the scenarios (energy demand, high population growth, and grid intensification) identified to achieve universal electrification in Narok by 2026 as modelled using OnSSET).

Results, and Key Insights

A sample analysis on the Energy Access Explorer, combining energy demand vs supply datasets to identify top priority areas for extending electricity access in Narok, is shown in **Figures 2**. Figure 1 shows the identification of priority areas which are close to health care and education facilities, far from the power network and where solar potential is significant. This is just one example; users can combine more than 50 geospatial datasets and generate custom prioritization analysis, maps, and reports based on their criteria and perspectives. Figure 3 shows how this information can be combined with OnSSET to identify the least cost electrification options.

- Most of the interviewees indicated that the Maa Community (the main ethnic community in Narok county) is mostly disadvantaged in utility electricity supply because of their nomadic nature. The interviewees affirmed that times have changed, and the community is more settled and can afford to pay for energy services. Widespread application of pico-solar was given as an example of the ability to pay, since the community members pay between USD 0.59–0.84 daily (1 USD=KES 118 as at the time of writing).
- An integrated, inclusive, data driven approach to planning helped understand local priorities, identifying supply options that can meet local demand and accelerate community buy-in.
- Capacity building for local stakeholders is essential for (a) collection of granular data; (b) development of data-driven insights with regards to integrated energy planning; (c) implementation of the developed plans; and (d) periodic updates.
- Standardizing the development of county energy plans which account for the energy needs from the bottom up is important for designing viable plans at national level.
- Focus Group Discussions revealed that most of the residents from Narok county are willing to pay for energy services and transition from traditional to modern cooking fuels. Residents also want to partner with the private sector in distribution of various technologies such as cookstoves and solar PV products to enhance job creation in the area.

Policy Recommendations

Based on our work in Narok County, below are some of the key recommendations that could help address the lack of energy data and analysis gaps.

- **National and sub-national governments, and energy planners should use and strengthen their capacity in geospatial data and analytical tools in order to support integrated energy planning**. For instance, **(1)** an online, interactive geospatial application that helps users make more informed decisions about areas for energy access interventions (e.g., Energy Access Explorer); **(2)** a least cost electrification modelling tool for estimating technology and investment requirements to reach certain energy access targets (OnSSET); and **(3)** a tool to support cost-effective data collection (Kobo collect).
- **County Governments and the Ministry of Energy need to work with Stakeholders to adopt a well-managed Dynamic Information System**. This will help address data collection, data sharing, and data governance challenges: such as data availability or usability; interoperability (energy data often lack standardization); provenance (not all data are equally trustworthy); prioritization (no definitive source on priority use cases); and decentralization (data sources are dispersed). [1]

- **Optimize data collection for better understanding aspects of demand and affordability:** Government and business premises should install (smart) meters to automatically record real time data on electricity consumption to aid planning for the demand side. The cost should be largely borne by energy suppliers as direct and beneficiaries and recovered from customer bills.
- **County Governments should consider enhancing community and cross departmental engagement** to inform prioritization of locally applicable solutions.

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